System and Method for One or More Extruders Using a Robotic Arms to Print a 3D Model

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Abstract

The need for creating realistic body parts and anatomical models using additive printing was long ago recognised. The paper "Rapid prototyping approaches for anatomical modelling in medicine" by M. McGurk et al. in Ann. R. Coll. Surg. Engl. 1997; 79; 169-174, which discussed 3-D printing of models, summarised the state of the art in this subject some years ago. Models were made by sprinkling liquid over a layer of precursor powder using inkjet printer nozzles to form a solid, thin slice. For each additional slice, the printing procedure was repeated until the item was finished as a "green state" component, which was then burned in a furnace to sinter it. The product was then subjected to further processing to create a full density portion. Large item 3D printing has been simpler than in previous years because to the development of software for computer controlled robotic XY motion systems used in the semiconductor and optical sectors. Layered building of 3D things is now a comparatively cheap and quick operation for 3D printing equipment thanks to software applications like SolidWorks, AutoCAD 360, and similar software products. Larger things may be 3D printed by either attaching rails above the print nozzles for X-Y motion directed from above the nozzles, or by positioning the object to be created on an X-Y table with motion supplied below the nozzles. The current work attempts to construct a 3D printing setup that utilises two robotic arms to print a single component. Here, the bed will be swivelled to a specific angle to prevent the robotic arms from becoming entangled, and the robotic arms will also move 180 degrees from their mean positions. Additionally, the related software will be developed locally in our lab, resulting in a shorter printing time and higher level of accuracy.

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1. Introduction

Rapid prototyping and early production processes have become increasingly common uses for 3D printing technologies. When used in early or experimental endeavors, 3D printing systems are often independent of other systems; nonetheless, they are not a part of the main production process. The current use also refers to the printing of items in three dimensions. More specifically, the application pertains to systems and techniques for developing, producing, using, and recycling supports for 3D-printed things. The application also pertains to systems and techniques for preventing inter-layer weakness in cushioning items made using 3D printing, including but not limited to insoles or seat cushions [1][2].

A system for printing a 3D model employing one or more extruders is provided by one embodiment of the invention considering the aforesaid. The system consists of a control panel and a 3D printer. The 3D printer has two components: one or more robotic arms that are connected to the printer's base and allow the extruders to print material on the printing surface; and (ii) a rotating base that rotates the printing surface. The one or more robotic arms contain the one or more extruders. Over the revolving base is where the printing surface is located [3].

The control unit has a CPU and memory. A set of instructions for printing the 3D model are stored in the memory. The processor carries out the set of 20 instructions, which are programmed to: (a) receive input from one or more user devices connected to a user; (b) convert the input into one or more step data using a 3D step file; (c) generate a control code based on the one or more step data to control movement of the one or more robotic arms and the rotating base; and (d) print the 3D model using the material over the printing surface using one or more extruders.

Some implementations of the system incorporate a collision control system that, before to printing the 3D model, assesses if one or more robotic arms will collide with each other as they move. When the collision control system recognizes the collision of the one or more robotic arms, it reroutes the one or more robotic arms and tilts the one or more extruders to prevent contact [4].

Depending on the user's input, certain implementations of the one or more robotic arms include nozzles with heating chambers that enable material to be applied to the printing surface. In certain implementations, the CPU is set up to divide the user's input into one or more step data to calculate how the one or more robotic arms would move while printing in three dimensions. To print the 3D model based on the input, the one or more step data also comprises motions of the one or more robotic arms. To evenly print the 3D model on the printing surface, the CPU allocates one or more symmetries to one or more robotic arms. According to various implementations, the rotating base connected to the base of one or more extruders spins at least partially in either the clockwise or anticlockwise direction to print the three-dimensional model. A motor is used to rotate the revolving base. In certain implementations, the control code is used to place one or more robotic arms to a starting position. In certain implementations, the CPU runs G codes and M codes to decide how the rotating base and one or more robotic arms should move to print the 3D object. In certain instances, the substance contains at least one of Poly Lactic Acid (PLA) or Acrylonitrile Butadiene Styrene, for example (ABS). Using one or more extruders, a technique for printing three-dimensional models.

The process comprises the steps of I receiving a user input using one or more input devices, (ii) converting the input into one or more step data using a 3D step file, (iii) generating a control code based on the one or more step data to control the movement of one or more robotic arms and a rotating base using a processor, and (iv) printing the 3D model using the material over the printing surface using one or more extruders. In certain implementations, a collision control system may be used to ascertain if the one or more robotic arms would collide before printing the 3D object. When the collision control system recognizes the collision of the one or more robotic arms, it reroutes the one or more robotic arms and tilts the one or more extruders to prevent contact. When taken into consideration in connection with the subsequent description and the accompanying drawings, these and other elements of the embodiments described here will be better appreciated and understood. However, it should be noted that despite identifying preferred embodiments and various precise aspects thereof, the following descriptions are offered for illustrative purposes only and are not intended to be exhaustive. Within the parameters of the embodiments herein, several adjustments and modifications may be performed, and all these adjustments are included in the embodiments herein. As previously said, a method to print a 3D model without harm and in the least amount of time is still required.

2. Illustrations

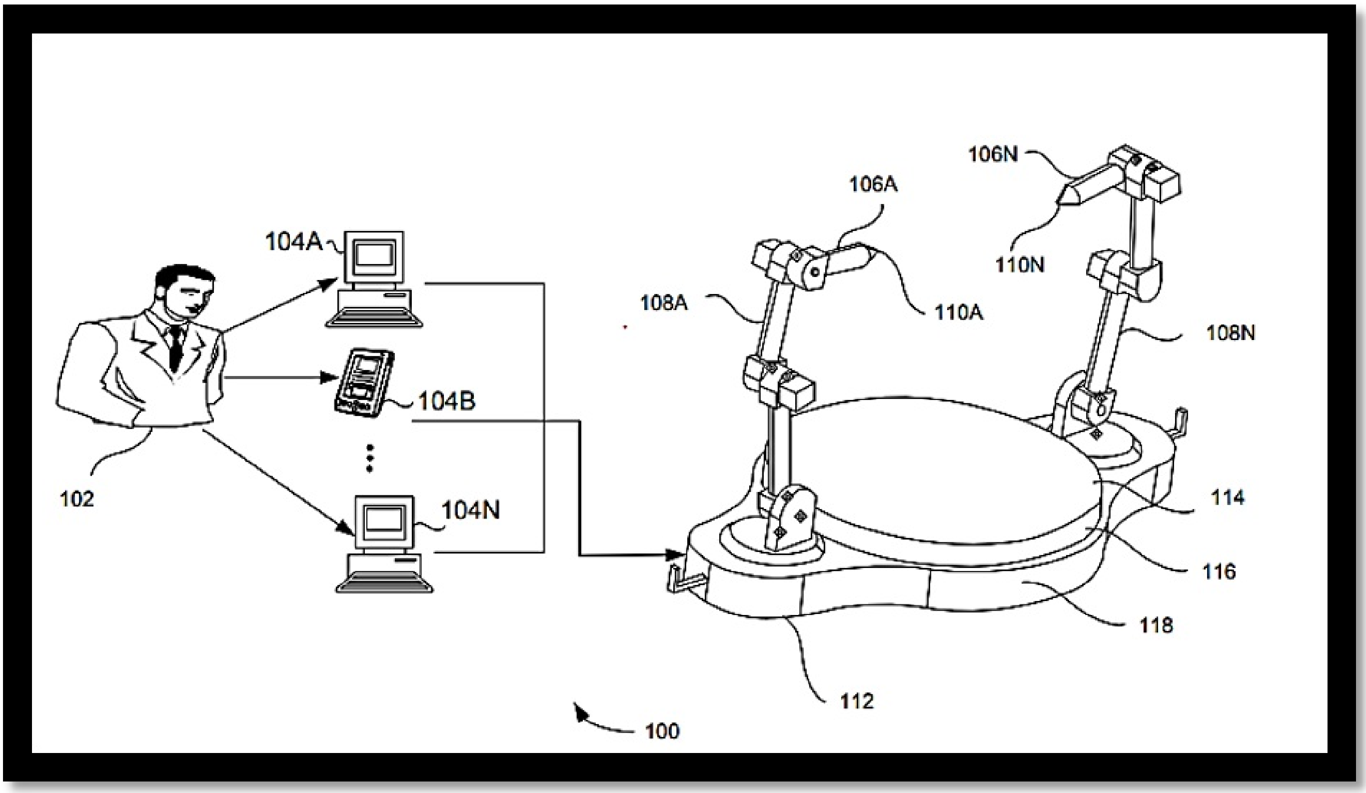

Fig. 1. Illustrates A System for Printing A 3d Model Using One Or More Extruders

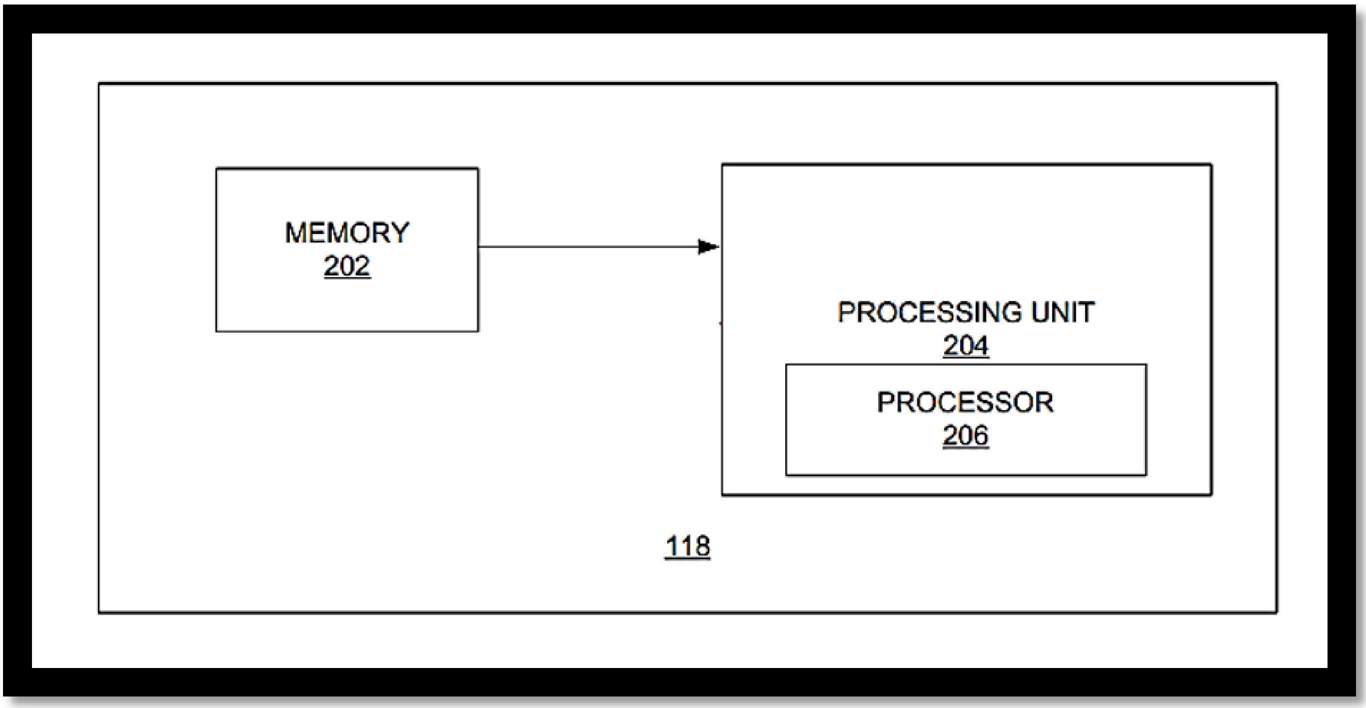

Fig. 2. Is A Block Diagram of a Control Unit Of Fig. 1

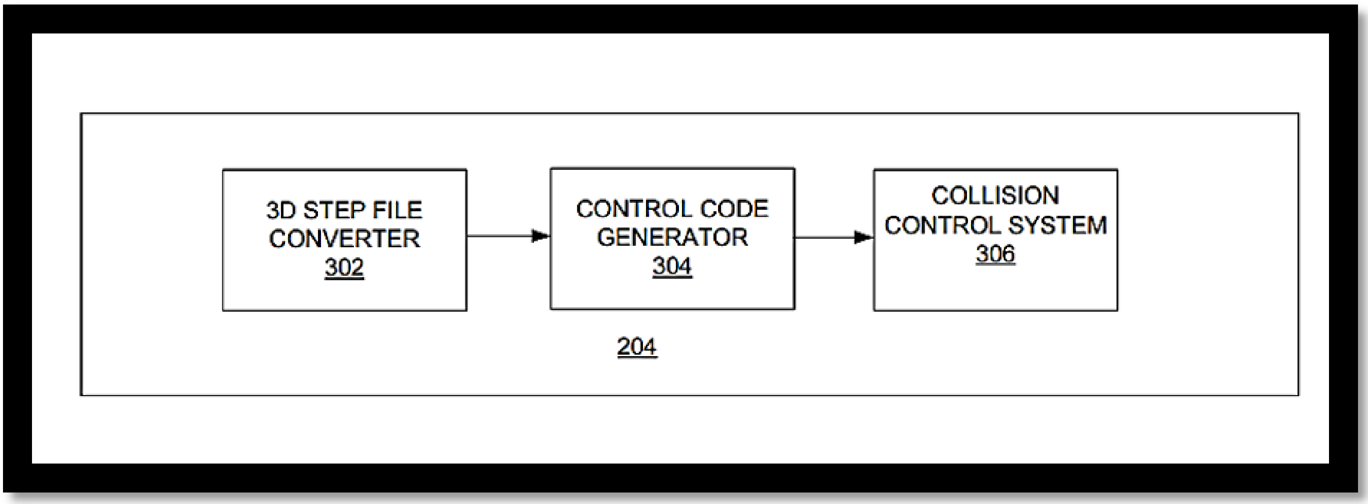

Fig. 3. Is A Block Diagram of a Control Unit Of Fig. 1

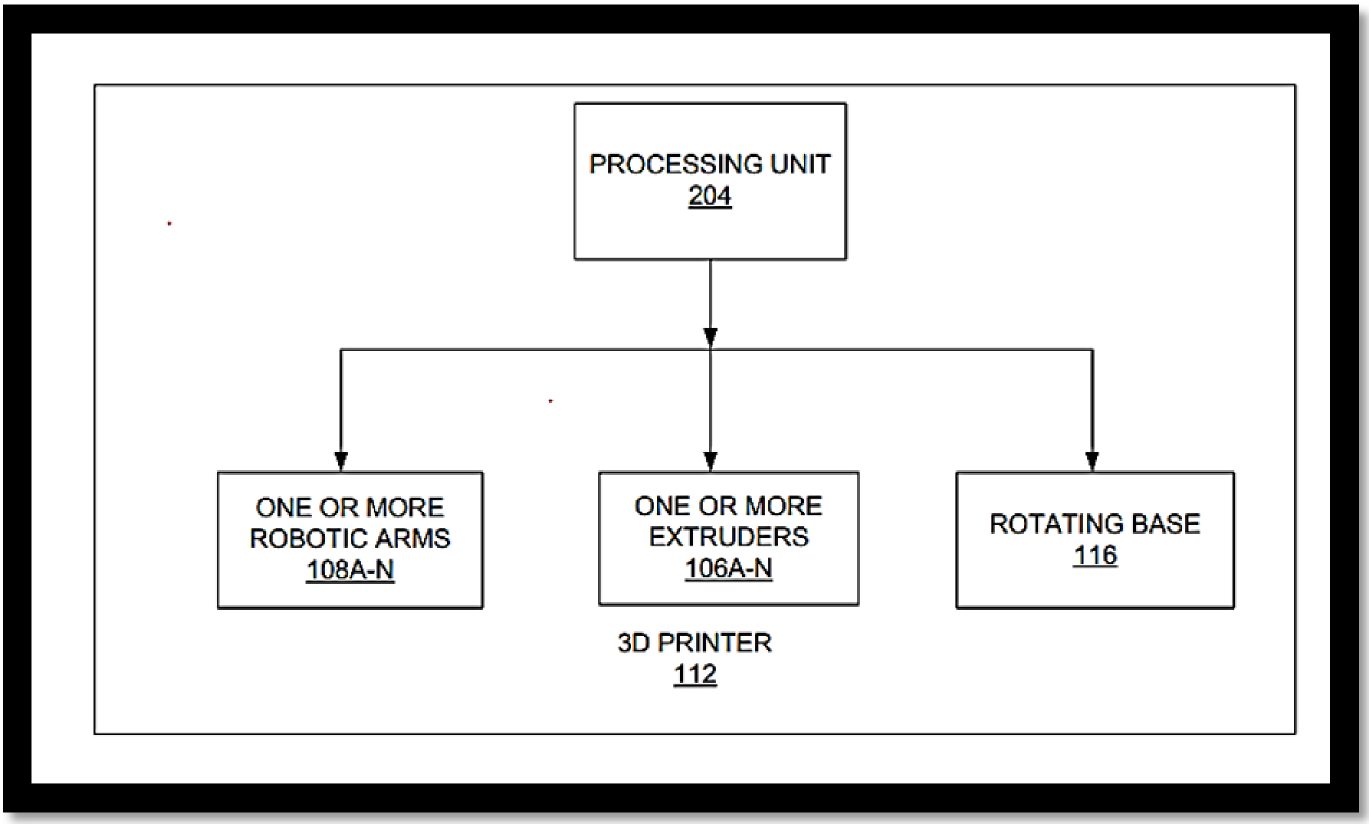

Fig. 4. Is A Block Diagram of the 3d Printer To Print 3d Model Using One Or More Robotic arms and a rotating base of FIG.1

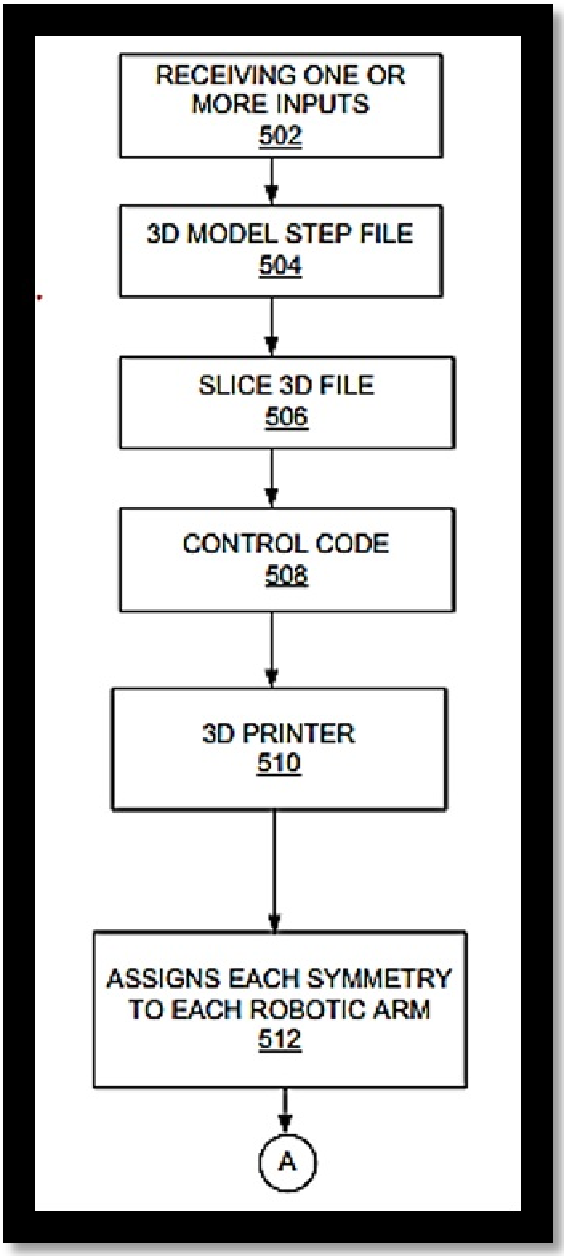

Fig. 5A. Illustrate Exemplary Flow Diagrams for Printing The 3D Model.

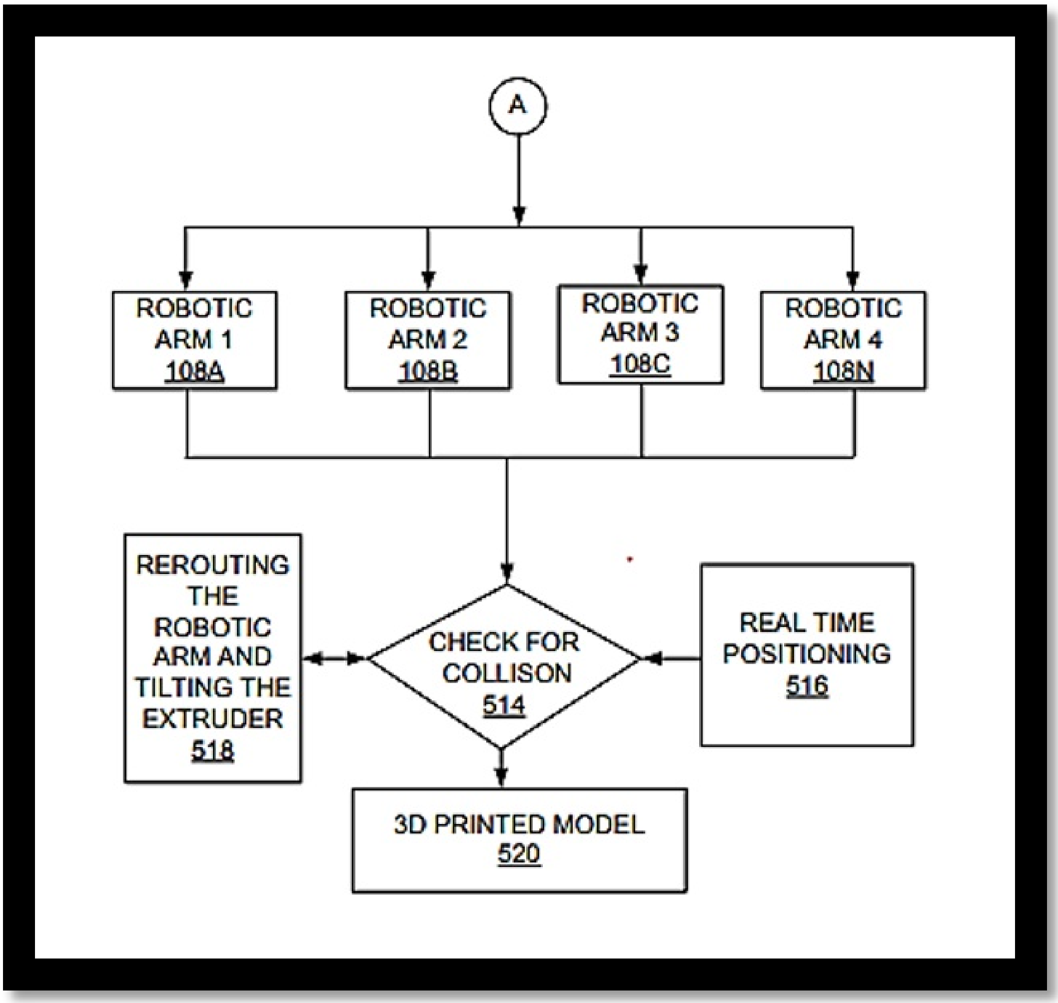

Fig. 5B. Illustrate Exemplary Flow Diagrams for Printing The 3D Model.

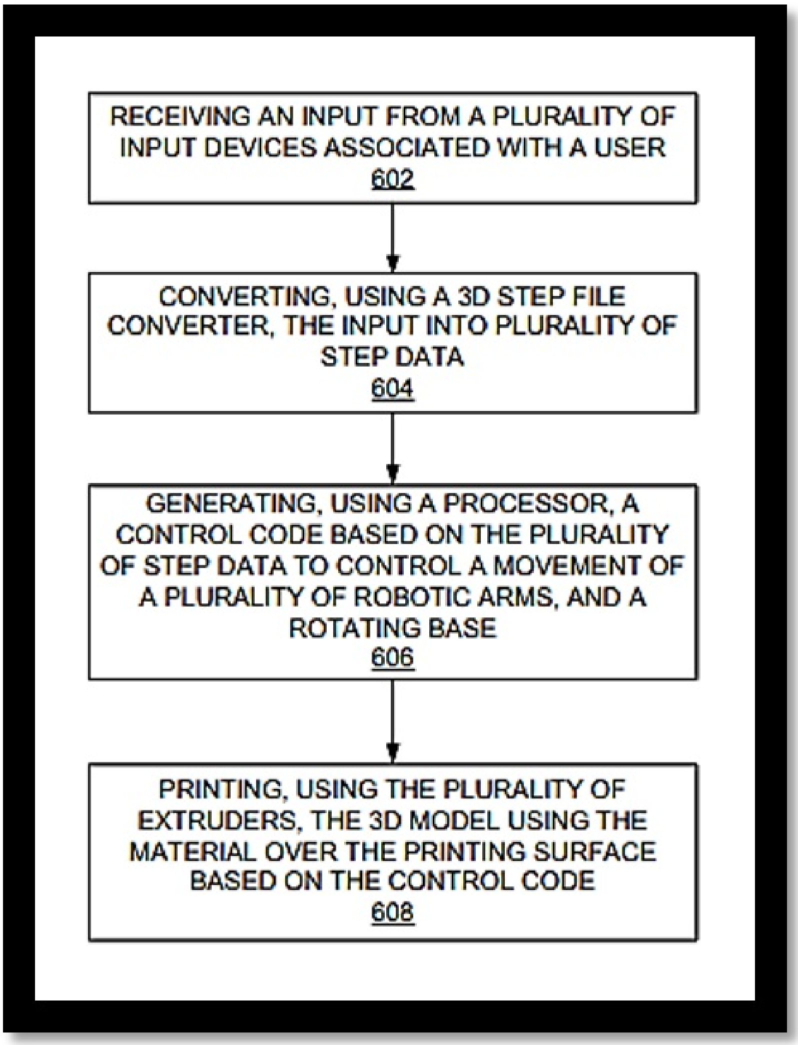

Fig. 6. Is A Method for Printing The 3d Model Using One Or More Extruders And One Or More Robotic Arms.

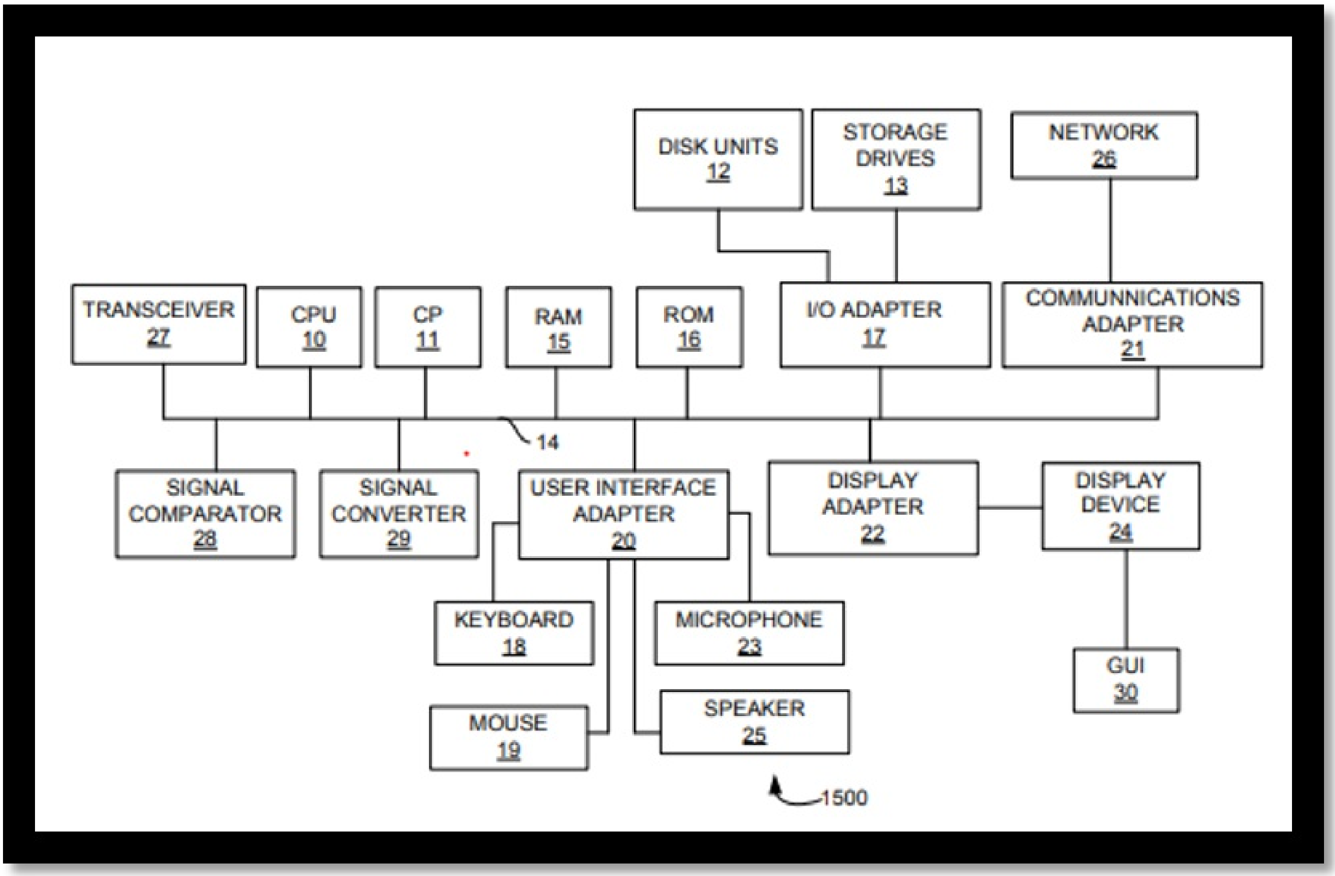

Fig. 7. Is A Schematic Diagram of A System Used.

A system that can print a 3D object using one or more extruders is still desired, as was previously noted. To print the 3D model, the system utilizes a rotating base and one or more robotic arms. In the following, preferable by way of the accompanying drawings, and more specifically by way of FIGS. 1 through 7.

Some implementations described herein include a system 100 for 3D printing a model utilizing one or more extruders. A 3D printer 112 is part of the system 100, alongside a user 102 and any number of input devices 104A-N. The user 102 is linked to the one or more input devices 104A-N so that they may provide feedback. Three-dimensional (2D) images, 2D text, and 3D graphics are all acceptable forms of input. One or more input devices 104A-N may include, but are not limited to, a mobile device, tablet device, or computer. At least one of the 3D drawings, 3D letters, or 3D photos may be created using an app on the one or more input devices 104A-N. One CAD program, one blender program, one sketch Up program, one rhino program, and one Revit program are all examples of the five or more programs that qualify. One or more extruders 106A-N, robotic arms 108A-N, a printing surface 114, a rotating base 116, one or more nozzles 110A-N, and a control unit 118 are all components of the 3D printer 112.In certain implementations, the 3D printer 112 is linked to the one or more user devices 104A-N by at least one of wired connection and wireless connection.

The rotating base 116 of the 3D printer 112 is where the robotic arms 108A-N are connected. One or more extruders 106A-N located inside one or more robotic arms 108A-N can print a material on a printing surface 114 thanks to the 3D printer 112. Poly lactic acid (PLA) or styrene-butadiene styrene (ABS) 15 may be used (ABS). The printing surface 114 of the 3D printer may be rotated thanks to the rotating base 116 that is linked to it. The user's input 102 is translated into step data by the control unit 118, which then directs the robotic arms 108A-N, the extruders 106A-N, and the rotating base 116 to perform the desired action. The one or more step data may contain, for example, instructions for moving the rotating base 116, the one or more extruders 106A-N, and the one or more robotic arms 108A-N, in any combination. The control unit 118 of the 3D printer 112 creates the control code to direct the motion of the one or more robotic arms 108A-N, the rotating base 116, and the one or more extruders 106A-N.

Conclusion

Efforts are being made to create a new kind of 3D printer that can produce prints in a shorter amount of time. That is the plan for this project, and everything will be made from scratch using local materials. Objects of varying shapes and sizes, including those that may be printed side by side or symmetrically, are all within the printer's capabilities. Multiple materials may be printed with only one printer by switching out the extruder.

Statements and Declarations

Conflict of Interest

There is no conflict of interest

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Appendix

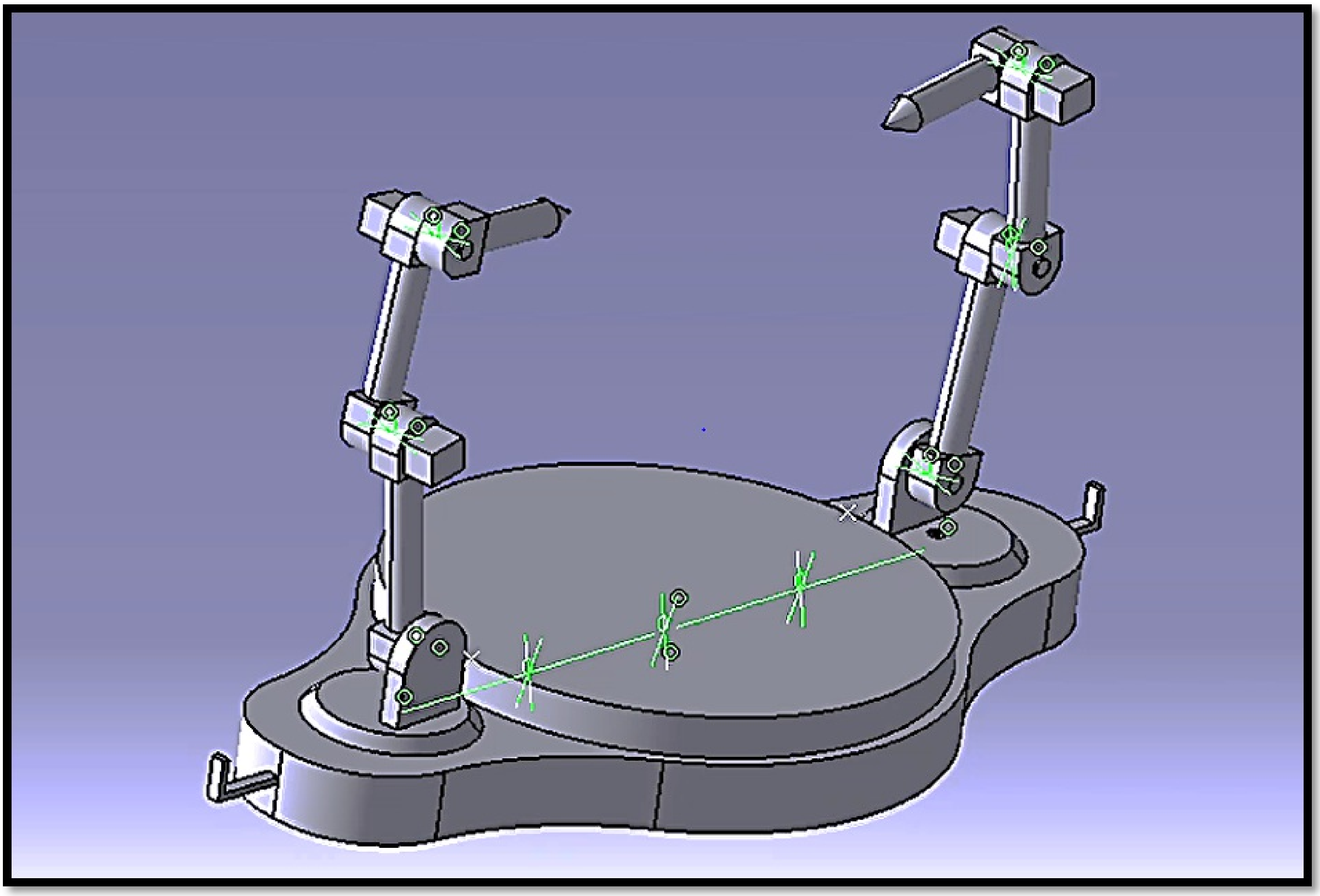

Fig. I. It shows the actual model of the work

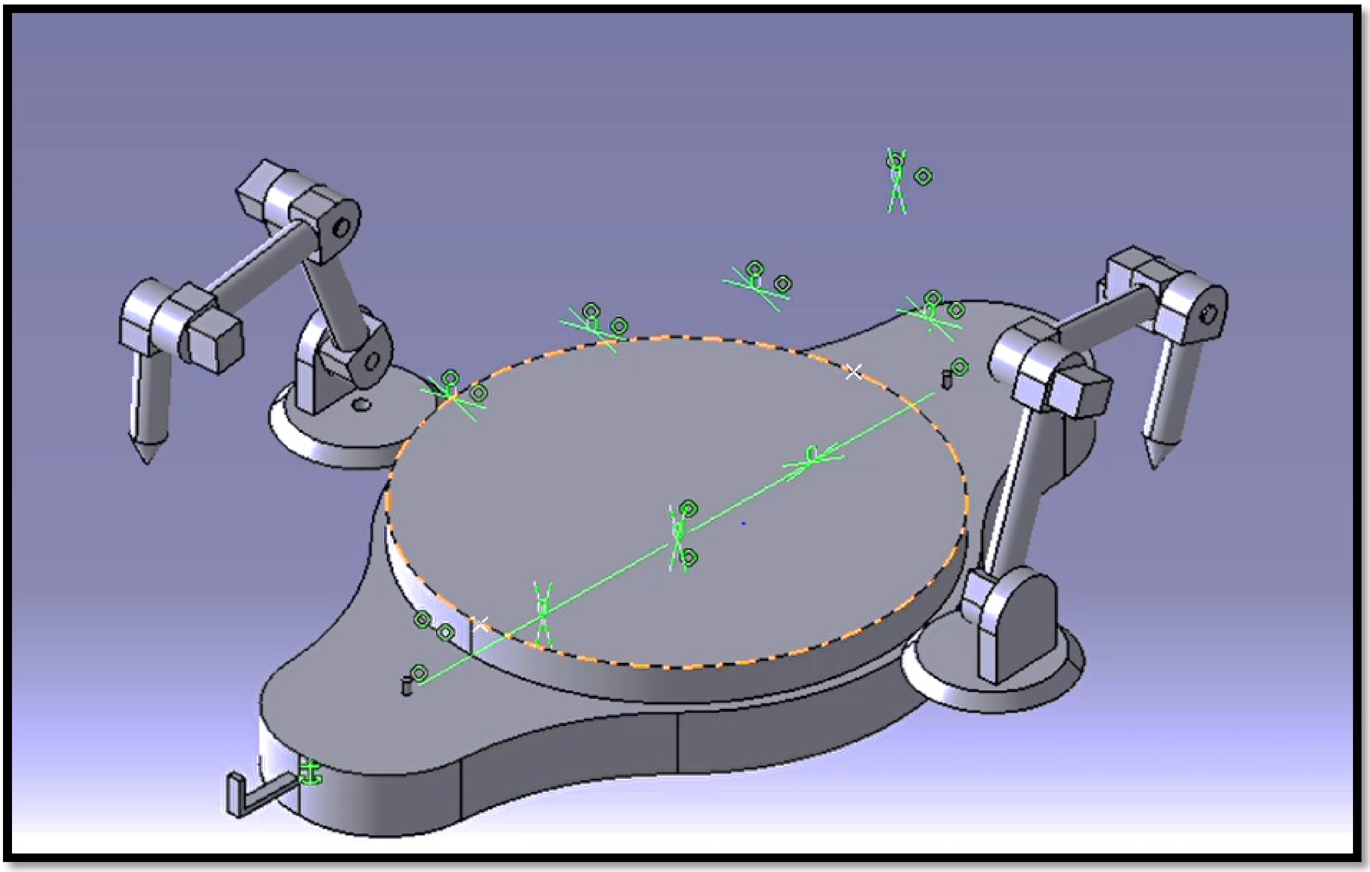

Fig. II. It shows the working model designed in the Catia software

References

1. ^*Tuan D. Ngo, Alireza Kashani, Gabriele Imbalzano, Kate T.Q. Nguyen, David Hui, Additive manufacturing (3D printing): A review of materials, methods, applications and challenges, Composites Part B: Engineering, Volume 143, 2018, Pages 172-196, ISSN 1359 8368, https://doi.org/10.1016/j.compositesb.2018.02.012*
2. ^*D. Srinivasan, M. Meignanamoorthy, M. Ravichandran, V. Mohanavel, S. V. Alagarsamy, C. Chanakyan, S. Sakthivelu, Alagar Karthick, T. Ram Prabhu, S. Rajkumar, "3D Printing Manufacturing Techniques, Materials, and Applications: An Overview", Advances in Materials Science and Engineering, vol. 2021, Article ID 5756563, 10 pages, 2021. https://doi.org/10.1155/2021/5756563*
3. ^*Cao, X.; Yu, S.; Cui, H.; Li, Z. 3D Printing Devices and Reinforcing Techniques for Extruded Cement-Based Materials: A Review. Buildings 2022, 12, 453. https://doi.org/10.3390/buildings12040453*
4. ^*Mick Sébastien, Lapeyre Mattieu, Rouanet Pierre, Halgand Christophe, Benois-Pineau Jenny, Paclet Florent, Cattaert Daniel, Oudeyer Pierre-Yves, de Rugy Aymar Reachy, a 3D-Printed Human-Like Robotic Arm as a Testbed for Human-Robot Control Strategies Frontiers in Neurorobotics VOLUME=13 YEAR=2019 DOI=10.3389/fnbot.2019.00065. ISSN=1662-5218*