IOT BASED 3D PRINTER

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Abstract— Sometimes Additive manufacturing, often referred to as 3D printing, has the potential to vastly accelerate innovation, compress supply chains, minimize materials and energy usage, and reduce waste.

Originally developed at the Massachusetts Institute of Technology in 1993. 3D printing technology forms the basis of Z Corporation's prototyping process. 3DP technology creates 3D physical prototypes by solidifying layers of deposited powder using a liquid binder. By definition 3DP is an extremely versatile and rapid process accommodating geometry of varying complexity in hundreds of different applications, and supporting many types of materials. Z Corp. pioneered the commercial use of 3DP technology, developing 3D printers that leading manufacturers use to produce early concept models and product prototypes. Utilizing 3DP technology, Z Corp. has developed 3D printers that operate at unprecedented speeds, extremely low costs, and within a broad range of applications. This paper describes the core technology and its related applications.

Additive manufacturing, often referred to as 3D printing, is a new way of making products and components from a digital model. Like an office printer that puts 2D digital files on a piece of paper, a 3D printer creates components by depositing thin layers of material one after another ,only where required , using a digital blueprint until the exact component has been created.

Interest in additive techniques is growing swiftly as applications have progressed from rapid prototyping to the production of end-use products. Additive equipment can now use metals, polymers, composites, or other powders to "print" a range of functional components, layer by layer, including complex structures that cannot be manufactured by other means.

By eliminating production steps and using substantially less material, 'additive' processes could be able to reduce waste and save more than 50% of energy compared to today's 'subtractive' manufacturing processes, and reduce material costs by up to 90%. The use of additive manufacturing can potentially benefit a wide range of industries including defense , aerospace, automotive, biomedical, consumer products, and metals manufacturing.

I. INTRODUCTION

3D printing or additive manufacturing (AM) is any of various processes for making a three-dimensional object of almost any shape from a 3D model or other electronic data source primarily through additive processes in which successive layers of material are laid down under computer control. A 3D printer is a type of industrial robot.

Early AM equipment and materials were developed in the 1980s. In 1984, Chuck Hull of 3D Systems Corp, invented a process known as stereo lithography employing UV lasers to cure photopolymers. Hull also developed the STL file format widely accepted by 3D printing software, as well as the digital slicing and infill strategies common to many processes today. Also during the 1980s, the metal sintering forms of AM were being developed (such as selective laser sintering and direct metal laser sintering), although they were not yet called 3D printing or AM at the time. In 1990, the plastic extrusion technology most widely associated with the term "3D printing" was commercialized by Stratasys under the name fused deposition modelling (FDM). In 1995, Z Corporation commercialized an MIT-developed additive process under the trademark 3D printing (3DP), referring at that time to a proprietary process inkjet deposition of liquid binder on powder.

AM technologies found applications starting in the 1980s in product development, data visualization, rapid prototyping, and specialized manufacturing. Their expansion into production (job production, mass production, and distributed manufacturing) has been under development in the decades since. Industrial production roles within the metalworking industries achieved significant scale for the first time in the early 2010s. Since the start of the 21st century there has been a large growth in the sales of AM machines, and their price has dropped substantially. According to Wohlers Associates, a consultancy, the market for 3D printers and services was worth $2.2 billion worldwide in 2012, up 29% from 2011. Applications are many, including architecture, construction (AEC), industrial design, automotive, aerospace, military, engineering, dental and medical industries, biotech (human tissue replacement), fashion, footwear, jewellery, eyewear, education, geographic information systems, food, and many other fields.

II. RECOGNITION OF PROJECT

We are making IOT based 3d printer which can be suitable for 3 axis

We are using Arduino MEGA with Ramp 1.4 shield for controlling stepper motor using A4988 motor driver and other hardware's.

III. BLOCK DIAGRAM

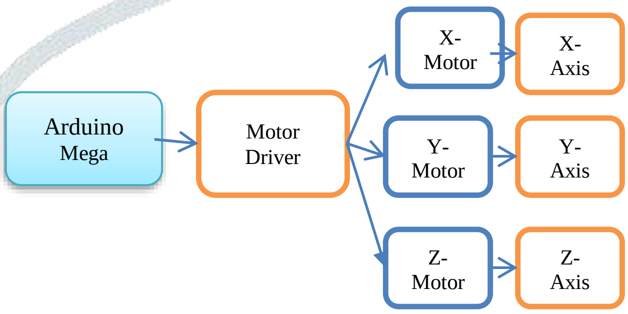


Fig.1: General Block diagram of 3D Printer

A. Block Diagram Description and working:

In Fig.1 The picture shows the structure of a typical 3D printer. The print table is the **platform** where the objects for printing has been situated. It provides the basic support for manufacturing objects layer by layer.

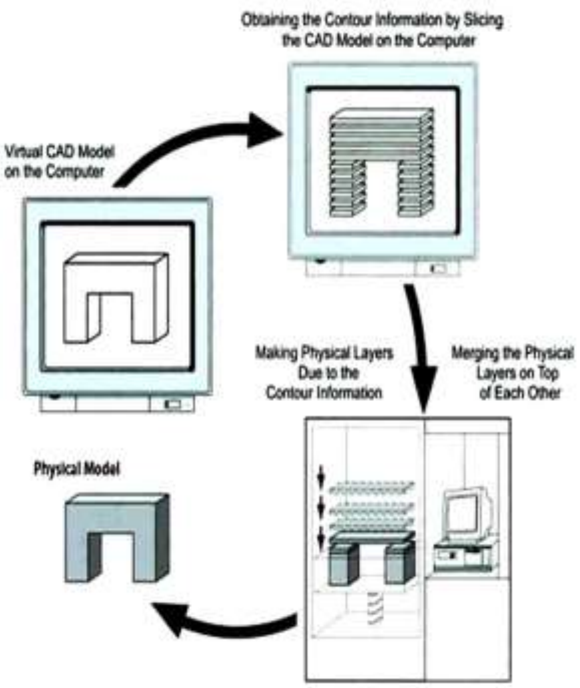
The extruder is the most important part of a 3D-Printer. As the extruders in the normal paper printers, this extruder is also used to pour ink for printing. The movement of extruder in various dimensions create the 3D print. For printing a 3d object. the extruder has to access X, Y and Z coordinates. For achieving this, many techniques are used according to the printer specification required for various applications.If the 3D-Printer is a desktop printer, the Z axis movement of the extruder can be avoided and that function can be transferred to the print table. This will avoid complexity in 3D printing as well as time consumption.

When the STL file is input to the printer, the microcontroller extracts each layer from it and also extracts each line segment from each layer. Then it gives controls to the movement of the extruder at required rate. The X-direction movement of extruder is made possible by the X-motor. When the X motor rotates, the shaft also rotates and the extruder moves in X direction. The Y-direction movement of extruder is made possible by the Y-motor. When the Y motor rotates; the shaft also rotates and the extruder moves in Y direction. The X direction movement is made by the print table.

In the case of desktop printers, the printing ink is usually plastic wire that has been melted by the extruder at the time of printing. While printing, the plastic wire will melt and when it fall down to the printing table.

Consider printing larger objects like house using 3D printer. There will not be any X motor or Y motor in that case. An extruder which can pour concrete mix is fixed on the tip of a crane. The crane is programmed for the movement of extruder in X,Y and Z axis. The concept and structure of 3d printer changes according to the type, size, accuracy and material of the object that has to be printed.Generalizing the facts, the extruder need to access all the 3 coordinates in space to print and object. The method used for that doesn't matters much

Fig. 2 software path



B. : Circuit Diagram

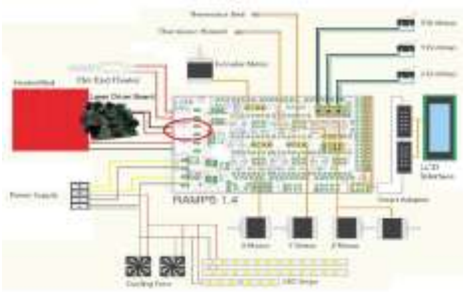


Fig.3 Circuit diagram

There are some procedures for printing. First you must create a computer model for printing the object. For creating that, you can use'Computer Aided Design Software like AutoCAD, 3DS Max etc. After the object file is created, the file need to be modified. The object file contains numerous amount of curves. Curves cannot be printed by the printer directly. The curves has to be converted to STL (Stereo lithography) file format. The STL file format conversion removes all the curves and it is replaced with linear shapes. Then the file need to be sliced into layer by layer. The layer thickness is so chosen to meet the resolution of the 3D printer we are using. If you are unable to draw objects in CAD software, there are many websites available which are hosted by the 3D printing companies to ease the creation of 3D object. The sliced file is processed and generates the special coordinates. These coordinates can be processed by a controller to generate required signal to the motor for driving extruder. This layer by layer process generate a complete object.

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IV. RESULT

3D Printed Model we can see which shown below Fig 4.

Fig. 4 3D Printed Model

V. ADVANTAGES

- Create anything with great geometrical complexity.
- Ability to personalize every product with individual customer needs.
- Produce products which involve great level of complexity that simply could not be produced physically in any other way.
- Additive manufacturing can eliminate the need for tool production and therefore reduce the costs, lead time and labour associated with it.
- 3D printing is an energy efficient technology.
- Additive Manufacturing use up to 90% of standard materials and therefore creating less waste.
- Lighter and stronger products can be printed.
- Increased operating life for the products.
- Production has been brought closer to the end user or consumer.
- Spare parts can be printed on site which will eliminate shipping cost.
- Wider adoption of 3D printing would likely cause re-invention of a number of already invented products.
- 3D printing can create new industries and completely new professions.
- Printing 3D organs can revolutionaries the medical industry.
- Rapid prototyping causes faster product development.

VI. DISADVANTAGES

- Since the technology is new, limited materials are available for printing.
- Consumes more time for less complicated pats.
- Size of printable object is limited by the movement of extruder.
- In additive manufacturing previous layer has to harden before creating next layer.
- Curved geometry will not be much accurate while printing.

VII. FUTURE SCOPE

NASA engineers are 3-D printing parts, which are structurally stronger and more reliable than conventionally crafted parts, for its space launch system. The Mars Rover comprises some 70 3-D-printed custom parts. Scientists are also exploring the use of 3-D printers at the International Space Station to make spare parts on the spot. What once was the province of science fiction has now become a reality.

Medicine is perhaps one of the most exciting areas of application. Beyond the use of 3-D printing in producing prosthetics and hearing aids, it is being deployed to treat challenging medical conditions, and to advance medical research, including in the area of regenerative medicine. The breakthroughs in this area are rapid and awe-inspiring.

Whether or not they arrive en-mass in the home, 3D printers have many promising areas of potential future application. They may, for example, be used to output spare parts for all manner of products, and which could not possibly be stocked as part of the inventory of even the best physical store. Hence, rather than throwing away a broken item (something unlikely to be justified a decade or two hence due to resource depletion and enforced recycling), faulty goods will be able to be taken to a local facility that will call up the appropriate spare parts online and simply print them out. NASA has already tested a 3D printer on the International Space Station, and recently announced its requirement for a high resolution 3D printer to produce spacecraft parts during deep space missions. The US Army has also experimented with a truck-mounted 3D printer capable of outputting spare tank and other vehicle components in the battlefield.

As noted above, 3D printers may also be used to make future buildings. To this end, a team at Loughborough University is working on a 3D concrete printing project that could allow large building components to be 3D printed on-site to any design, and with improved thermal properties.

Another possible future application is in the use of 3D printers to create replacement organs for the human body. This is known as bio printing, and is an area of rapid development. You can learn more on the bio printing page, or see more in my bio printing or the Future Visionsgallery.

VIII. CONCLUSION

As the 3D printer is a device, it should be analyzed with the advantages and disadvantages, how the device can change the society and engineering etc in mind. The very nature of 3D printing, creating a part layer by layer, instead of subtractive methods of manufacturing lend themselves to lower costs in raw material. Instead of starting with a big chunk of plastic and carving away (milling or turning) the surface in order to produce your product. Additive manufacturing only "prints" what you want, where you want it. Other manufacturing techniques can be just as wasteful. 3D printing is the ultimate just-in-time method of manufacturing. No longer do you need a warehouse full of inventory waiting for customers. Just have a 3D printer waiting to print your next order. On top of that, you can also offer almost infinite design options and custom products. It doesn't cost more to add a company logo to every product you have or let your customers pick every feature on their next order, the sky is the limit with additive manufacturing.

Whether you are designing tennis shoes or space shuttles, you can't just design whatever you feel like, a good designer always take into account whether or not his design can be manufactured cost effectively. Additive manufacturing open up your designs to a whole new level. Because undercuts, complex geometry and thin walled parts are difficult to manufacture using traditional methods, but are sometimes a piece of cake with 3D printing. In addition, the mathematics behind 3D printing are simpler than subtractive methods. For instance, the blades on a centrifugal supercharger would require very difficult path planning using a 5-axis CNC machine. The same geometry using additive manufacturing techniques is very simple to calculate, since each layer is analyzed separately and 2D information is always simpler than 3D. This mathematical difference, while hard to explain is the fundamental reason why 3D printing is superior to other manufacturing techniques. It almost always better to keep things simple and additive manufacturing is simple by its very nature.

With so many potential benefits of 3D printing, there's no surprise that this method is making its way through a diverse number of industries and quickly becoming a favorite tool of progressive marketers.

Comparing the numerous advantages, applications and future scope, we can conclude that the 3D printer and its technology is able to create next industrial revolution.

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