

CONCEPTUAL UTILISATION OF ADDITIVE MANUFACTURING WITH “3D- PRINTING”

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ABSTRACT

3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. It is also known as rapid prototyping, is a mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. The 3D printing concept of custom manufacturing is exciting to nearly everyone. This revolutionary method for creating 3D models with the use of inkjet technology saves time and cost by eliminating the need to design; print and glue together separate model parts. Now, you can create a complete model in a single process using 3D printing. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern.

It can make physical models of objects either designed with a CAD program or scanned with a 3D Scanner. It is used in a variety of industries including jewellery, footwear, industrial design, architecture, engineering and construction, automotive, aerospace, dental and medical industries, education and consumer products.

The aim of this project is Designing and implementation of 3D printing designs using X,Y,Z axis CNC machine by using designed input data. This session will demonstrate how the application of technological advances can affect us, using the excitement of creating student-designed 3-dimensional objects. A photoactive polymer is initiated by the UV light emitted from a simple data projector.

INTRODUCTION

Manufacturing methods

The manufacturing process used in engineering industries basically performs to Change the physical properties of the job & Change the physical parameters of the job by producing the desired accuracy and surface finish on the job. Based on the nature of work involved these processes are divided as Casting Processes, Forming processes, Joining processes, Machining Processes & Surface finishing processes. Depending upon the flexibility of machining the job, the manufacturing methods can be classified as

- Additive manufacturing
- Subtractive manufacturing

Additive manufacturing technique is defined as a process of adding of the materials to make objects from three dimensional (3D) object by layer-by-layer. Additive manufacturing technologies are generally based on three basic steps as follows. First, a 3D solid model of a part is built in the specified CAD software and converted into a standard AM file format (the .stl file format) finally the file is then sent to an AM machine which builds the part layer-by-layer.

Subtractive manufacturing technique defined as the process of removing the material in small amounts from a solid material by involving various machining processes like drilling, milling, turning, cutting, etc. Subtractive manufacturing technologies are generally performed on selected machines where the excess material is removed from the raw material in small amounts, thus obtaining the final finished object. Subtractive manufacturing technologies are done on machines which are operated manually (Drilling, Milling, etc) and some are of the computer controlled (CNC machines).

Depending upon the physical parameters, design, machining conditions and utilisation of the product the respective technologies viz..., Additive manufacturing or subtractive manufacturing will be selected by the operator.

WHY “Additive Manufacturing”?

Additive manufacturing is the modern machining technology which builds 3D objects by adding layer-by-layer of material on base of the template designed in an CAD software.

Additive manufacturing technology has new opportunities for the economy and society which facilitate the production of strong light-weight products for the aerospace industry and it allows designs that were not possible with previous manufacturing techniques.

Additive manufacturing technology is majorly preferable because it is the manufacturing process which does not involve the use of moulds or extra tooling agents to create different products. The additive manufacturing

process involves taking a CAD design of the product and printing it out layer by layer. Whereas with the utilisation of typical traditional manufacturing techniques, such as casting or moulding, to create a new product, the manufacturer has to create a mould with the template of the product first. So additive manufacturing does not require different moulds for different products with which the manufacturers find a unique capability to utilize varying designs on the same additive manufacturing machine by designing them in the selected CAD software's. With effect to this the additive manufacturing technologies could change the paradigm for manufacturing, moving away from mass production in factories and high costs.

Additive Manufacturing involves the following basic steps

1. Designing of the model: A template of the respective model is designed in the CAD software.
2. Processing the data: The designed data is been linked with the manufacturing machine to undergo machining.
3. Machining the job: Finally the job is machined by layer-to-layer deposition which creates the 3D object.

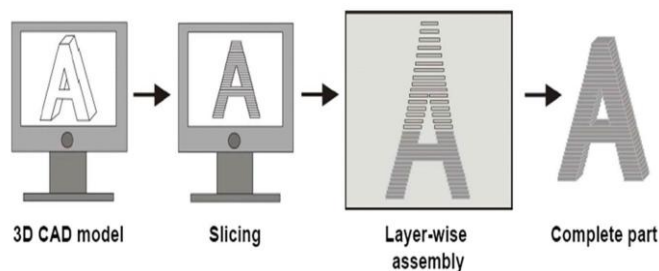


Fig: Conceptualising of a 3D model

Various types of Additive manufacturing methods

Additive manufacturing is a simple and sophisticated method which is used for the manufacturing of complex and intricate shaped 3D structures. Depending upon the operation of the job the additive manufacturing methods are been classified as

➤ Fusion deposition method

This technology of additive manufacturing was developed by Scott Crump in 1980, where an 3D object is created by layer-by-layer deposition of a plastic filament / metal wire

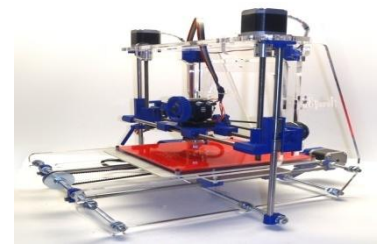


Fig: Fusion deposition method

➤ Laminated object manufacturing

LOM method was developed by helisys inc. It is a rapid prototyping system where a adhesive coated plastic laminates are successfully glued together.

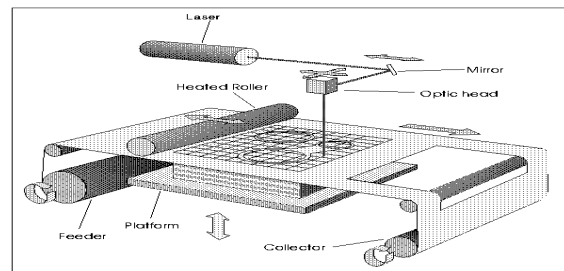


Fig: Laminated object manufacturing

➤ Selective laser sintering

SLS method was developed by Dr. Carl Deckard, which is an intelligent manufacturing technique with the utilisation of a powder metal additives with rapid prototyping technology. A powder metal is deposited on the platform of the machine wherein a CO² gas will solidify that powder material.

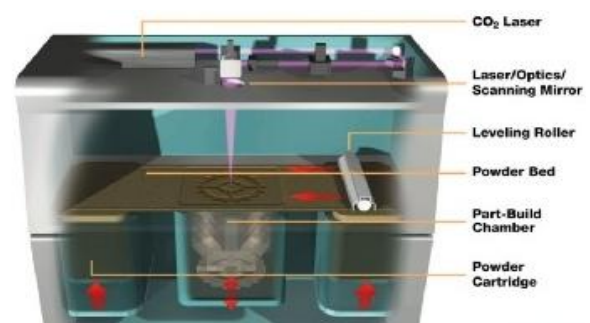
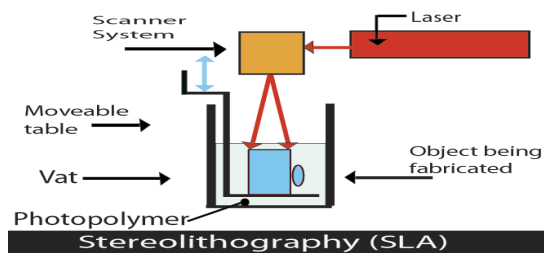


Fig: SLS method

➤ Stereo lithography

Stereo lithography is currently the most widely used process in the rapid prototyping and manufacturing field. It translates computer aided design (CAD) into solid objects through a combination of laser, photochemistry and software technologies to produce the solid 3D objects.



Concept of 3D printing

The concept of 3D printing was first proposed by Jeremy Rifkin in the 19th century, where a binder material is deposited on a table by adding layer-by-layer with the base of an inkjet printer.

3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. It is also known as rapid prototyping, is a mechanized method whereby 3D objects are quickly made on a reasonably sized machine connected to a computer containing blueprints for the object. The 3D printing concept of custom manufacturing is exciting to nearly everyone. This revolutionary method for creating 3D models with the use of inkjet technology saves time and cost by eliminating the need to design; print and glue together separate model parts. Now, you can create a complete model in a single process using 3D printing. The basic principles include materials cartridges, flexibility of output, and translation of code into a visible pattern.

It can make physical models of objects either designed with a CAD program or scanned with a 3D Scanner. It is used in a variety of industries including jewellery, footwear, industrial design, architecture, engineering and construction, automotive, aerospace, dental and medical industries, education and consumer products.

When it comes to 3D printing, thoughts often tend towards the endless opportunities to build and create things and shapes that were previously impossible. However, 3D printing is also a perfect technology for fixing the previously unfixable, when producing spare parts either isn't viable or it's insanely expensive.



Fig: 3D printing machine

Background Embedded

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function.

Application Areas of Embedded Systems

The embedded system market is one of the highest growth areas as these systems are used in very market segment- consumer electronics, office automation, industrial automation, biomedical engineering, wireless communication, Data communication, telecommunications, transportation, military and so on.

Consumer Appliances: At home we use a number of embedded systems which include digital camera, digital diary, DVD player, electronic toys, microwave oven, remote controls for TV and air-conditioner, VCO player, video game consoles, video recorders etc.

Office Automation: The office automation products using embedded systems are copying machine, fax machine, key telephone, modem, printer, scanner etc.

Industrial Automation: Today a lot of industries use embedded systems for process control. These include pharmaceutical, cement, sugar, oil exploration, nuclear energy, electricity generation and transmission

Medical Electronics: Almost every medical-equipment in the hospital is an embedded system. These equipments include diagnostic aids such as ECG, EEG, blood pressure measuring devices, X-ray scanners; equipment used in blood analysis, radiation, colonoscopy, endoscopy etc. Developments in medical electronics have paved way for more accurate diagnosis of diseases.

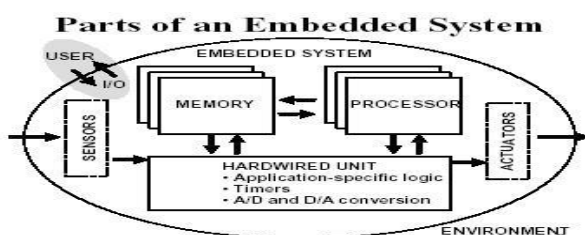
Computer Networking: Computer networking products such as bridges, routers, Integrated Services Digital Networks (ISDN), Asynchronous Transfer Mode (ATM), X.25 and frame relay switches are embedded systems which implement the necessary data communication protocols. For example, a router interconnects two networks.

Telecommunications: In the field of telecommunications, the embedded systems can be categorized as subscriber terminals and network equipment. The subscriber terminals such as key telephones, ISDN phones, terminal adapters, web cameras are embedded systems. The network equipment includes multiplexers, multiple access systems, Packet Assemblers Disassemblers (PADs), satellite modems etc. IP phone, IP gateway, IP gatekeeper etc. are the latest embedded systems that provide very low-cost voice communication over the Internet.

Wireless Technologies: Advances in mobile communications are paving way for many interesting applications using embedded systems. The mobile phone is one of the marvels of the last decade of the 20th century. It is a very powerful embedded system that provides voice communication while we are on the move. Mobile communication infrastructure such as base station controllers, mobile switching centers are also powerful embedded systems.

Insemination: Testing and measurement are the fundamental requirements in all scientific and engineering activities. The measuring equipment we use in laboratories to measure parameters such as weight, temperature, pressure, humidity, voltage, current etc. are all embedded systems. Test equipment such as oscilloscope, spectrum analyzer, logic analyzer, protocol analyzer, radio communication test set etc. are embedded systems built around powerful processors.

Security: Security of persons and information has always been a major issue. We need to protect our homes and offices and also the information we transmit and store. Developing embedded systems for security applications is one of the most lucrative businesses nowadays. Security devices at homes, offices, airports etc. for authentication and verification are embedded systems.



CURRENT 3D PRINTING TECHNOLOGIES

Inkjet - inkjet is a type of computer printing that recreates a digital image by propelling droplets of ink onto paper, plastic, or other substrates. Inkjet printers are the most commonly used type of printer, and range from small inexpensive consumer models to very large professional machines

Stereo lithography - Stereo lithographic 3D printers (known as SLAs or stereo lithography apparatus) position a perforated platform just below the surface of a vat of liquid photo curable polymer. A UV laser beam then traces the first slice of an object on the surface of this liquid, causing a very thin layer of photopolymer to harden. The perforated platform is then lowered very slightly and another slice is traced out and hardened by the laser. Another slice is then created, and then another, until a complete object has been printed and can be removed from the vat of photopolymer, drained of excess liquid, and cured.

Fused deposition modelling - Here a hot thermoplastic is extruded from a temperature-controlled print head to produce fairly robust objects to a high degree of accuracy.

Selective laser sintering (SLS) - This builds objects by using a laser to selectively fuse together successive layers of a cocktail of powdered wax, ceramic, metal, nylon or one of a range of other materials.

Materials used in 3D Printing

Plastics

At the moment the majority of 3D Printers, especially the low cost systems, print using a technology called 'Fused filament fabrication (FFF)', these printers currently tend to print using one of the following materials:

PLA (Polylactic Acid) – PLA is probably the easiest material to work with when you first start 3D printing. It is an environmentally friendly material that is very safe to use, as it is a biodegradable thermoplastic that has been derived from renewable resources such as corn starch and sugar canes.

ABS (Acrylonitrile butadiene styrene) – ABS is considered to be the second easiest material to work with when you start 3D printing. It's very safe and strong, and widely used for things like car bumpers, and lego (the kids toy).

PVA (Polyvinyl Alcohol Plastic) – PVA plastic which is quite different to PVA Glue (please don't try putting PVA Glue into your 3D Printer, it definitely won't work). The popular Makerbot Replicator 2 printers use PVA plastic powders

The higher end printers, can use various powder based materials to create 3D objects, these objects can include:

- **Polyamide** – Which is a strong and flexible material that allows a high level of detail to be achieved? Polyamide objects are constructed from a white, very fine, granular powder.

- **Alumide** – Is a Polyamide-like material with a distinctive sandy and granular look that is a rigid and strong material. Alumide objects are constructed from a blend of gray aluminum powder and polyamide, a very fine granular powder.
- **Multicolor** – A full color material with a sandy and granular appearance. Models made out of multicolor are constructed from a fine granular powder.



Fig Plastic material

Resins

Resins are also a material sometimes used in 3D Printing, although design freedom is limited due to the structure necessary to support the objects during the printing process. The following are examples of some resins that can be used:

- **High detail resin** – Objects made out of high detail resin are constructed from a photo polymeric liquid. This material is ideal for small and/or very finely-detailed visual models, where high detail is required.
- **Paintable resin** – Objects made out of paintable resin have a smooth surface and will look beautiful painted.
- **Transparent resin** – Objects made out of transparent resin are constructed from a hardened liquid. The material is strong, hard, stiff, water resistant by nature, and of course, transparent. Transparent resin is suited for models needing a good, smooth, quality surface with a transparent look.



Fig Resin material

Other Materials

- **Titanium** – Is very light and the strongest 3D printing material available. Objects made from titanium are printed using titanium powder that is sintered together by a laser.
- **Stainless steel** – Object produced in stainless steel are 3D printed using a stainless steel powder that is infused with bronze material. Stainless steel is the cheapest

form of metal printing, very strong and suitable for very large objects.

- **Bronze** – Objects produced in bronze are 3D printed in using a bronze powder that is infused with bronze. Bronze is an affordable and strong material for printing models in metal.
- **Brass, Silver, Gold** – Can also be used in 3D printing, although involves printing a wax mould which is then filled with the molten material.
- **Ceramics** – A 3D printing material that has a shiny appearance, is heat resistant, recyclable and food safe. Models made out of ceramics are constructed from alumina silica ceramic powder, then sealed with porcelain and silica and glazed. A perfect material for home decor items and tableware.



Fig: Ceramic materials

ATMEGA16 Micro Controller

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.

ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively.

ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.



Fig: ATMEGA 16 micro controller

Bridge Rectifier

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

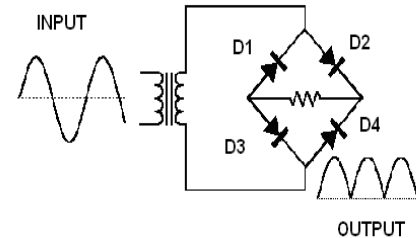


Fig Bridge rectifier

Power Supply

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function. A D.C power supply which maintains the output voltage constant irrespective of A.C mains fluctuations or load variations is known as Regulated D.C Power Supply.

Transformer

A transformer is an electrical device which is used to convert electrical power from one Electrical circuit to another without change in frequency. Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase in output voltage, step-down transformers decrease in output voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage to a safer low voltage.



Fig: transformer

Rectifier

A circuit which is used to convert a.c to dc is known as RECTIFIER. The process of conversion a.c to d.c is called "rectification".

Full-Wave Rectifier

From the above comparison we came to know that full wave bridge rectifier has more advantages than the other two rectifiers. So, in our project we are using full wave bridge rectifier circuit.

Regulator

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative voltage regulators are available, mainly for use in dual supplies. Many of the fixed voltage regulator ICs have 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right.



Fig: Regulator

Stepper Motor

A stepper motor to satisfy all your robotics needs! This 4-wire bipolar stepper has 1.8° per step for smooth motion and a nice holding torque. The motor was specified to have a max current of 350mA so that it could be driven easily with an Adafruit motor shield for Arduino (or other motor driver) and a wall adapter or lead-acid battery



Fig: Stepper motor

H-Bridge

An H bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards. In particular, a bipolar stepper motor is almost invariably driven by a motor controller containing Two H Bridges.

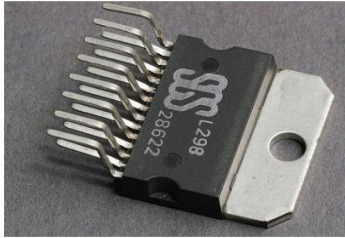


Fig: H- bridge

How it Works

The different types of 3D printers each employ a different technology that processes different materials in different ways. It is important to understand that one of the most basic limitations of 3D printing — in terms of materials and applications — is that there is no ‘one solution fits all’. For example some 3D printers process powdered materials (nylon, plastic, ceramic, metal), which utilize a light/heat source to sinter/melt/fuse layers of the powder together in the defined shape. Others process polymer resin materials and again utilize a light/laser to solidify the resin in ultra thin layers. Jetting of fine droplets is another 3D printing process, reminiscent of 2D inkjet printing, but with superior materials to ink and a binder to fix the layers. Perhaps the most common and easily recognized process is deposition, and this is the process employed by the majority of entry-level 3D printers. This process extrudes plastics, commonly PLA or ABS, Start with a 3D CAD file either by creating the 3D model or scanned with a 3D scanner.

Various steps involved in 3D printing technology:

1. **Glass piece** – This is needed for the heat bed. We don't usually ship this with our kit.
2. **Power supply** – You will need a 12 V power supply, This manual has full instructions on wiring a standard 12 v power supply to the printer
3. **Filament** – For ideal printing experience, you will need good quality filament poly carbon.

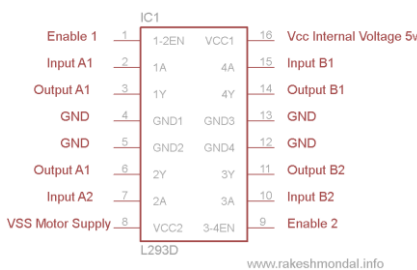
The various parts which makes the 3D printing machine are illustrated below:



Fig: Sub-assembly parts

L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).

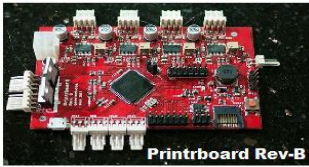


3D Printing Technology

The starting point for any 3D printing process is a 3D digital model, which can be created using a variety of 3D software programs in industry this is 3D CAD, for Makers and Consumers there are simpler, more accessible programs available — or scanned with a 3D scanner. The model is then ‘sliced’ into layers, thereby converting the design into a file readable by the 3D printer. The material processed by the 3D printer is then layered according to the design and the process. As stated, there are a number of different types of 3D printing technologies, which process different materials in different ways to create the final object. Functional plastics, metals, ceramics and sand are, now, all routinely used for industrial prototyping and production applications.



Fig: Heated bed



1x Power supply

Fig: Power supply



Fig: Fixtures

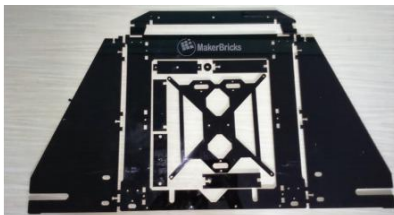


Fig: Acrylic frame

After assembling of all the parts 3D printing machine will appear as:

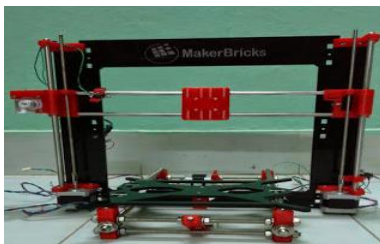


Fig: 3D printing machine model

Software Tools used in a 3D printing technology:

1. Designing tools
2. Slic3r tools
3. Pronterface

CAD Tools

Computer Aided Design, or CAD, tools are used to design 3D parts for printing. CAD tools in the truest sense are designed to allow you to easily change and manipulate parts based on parameters. Sometimes CAD files are referred to as parametric files. They usually represent parts or assemblies in terms of Constructive Solid Geometry on primitive shapes such as cubes, spheres, cylinders, pyramids, etc.

Typically in such programs the geometry is stored in a feature tree where the dimensions can be modified numerically, and the geometry is then regenerated with great precision. This can be quite beneficial when making drawings with dimensions between the circle and sections that need to be concentrically removed.

Files

Most of the time 3D software apps save their files in an application-specific format, which in the case of proprietary CAD tools usually are frequently changed and heavily guarded trade secrets. There are very few interchangeable CAD file formats. The two most widely used interchangeable CSG file formats are STEP and IGES. The most widely used interchangeable mesh file format is STL. STL files are important because, as we will see below, they are used by CAM tools.

G-codes

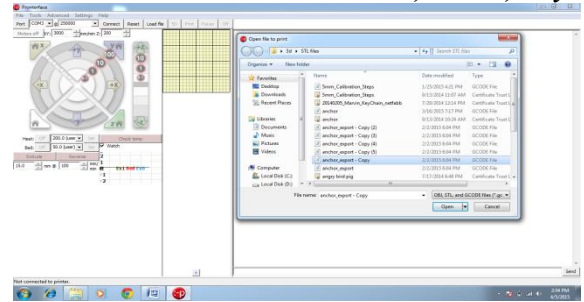
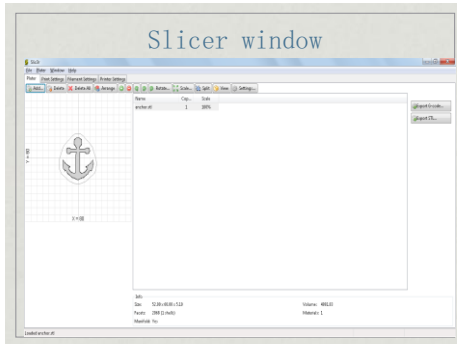
After your microcontroller has its firmware loaded, it is ready to accept G-codes via the software-emulated RS-232 serial port (aka COM port). This port shows up when you plug in your arguing to the PC via USB. You can either use a program to send these G-codes over the serial port or you can type them in by hand if you fire up a plain-old terminal application like hyper term or mini com. If you use a program, they generally take files in g code format.

Part Files

The main files use by CAM tools are STL and G-code files. CAM tools convert STL files into G-code files. The official STL files for Mendel are stored in the Rep Rap subversion repository

This will create a directory full of STL files that you can then give to your neighbor that already has a RepRap and they can print out the parts for you. You will also notice that this directory containsAol files. It is the CAD application that was used to design the parts and then save them as STL files.

After your microcontroller has its firmware loaded, it is ready to accept G-codes via the software-emulated RS-232 serial port (aka COM port). This port shows up when you plug in your arduino to the PC via USB. You can either use a program to send these G-codes over the serial port or you can type them in by hand if you fire up a plain-old terminal application like hyperterm or minicom. If you use a program, they generally take files in gcode format.



10. Then click on print option

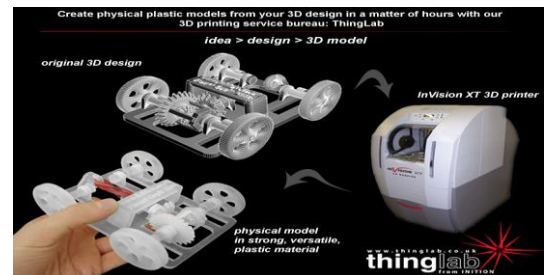
11. The 3d printer starts printing 3d object.

Maintenance of 3d Printer

1. Smooth rods should be oiled regularly with machine oil.
2. From time to time ensure that connections are firm and the nuts and bolts are not loose.
3. Ensure the printer is on a solid surface.

Applications

- Industrial Design



- Automotive And Aviation Industries



☺ Automotive and aviation industries use 3D printers to make body parts.

☞ 2010

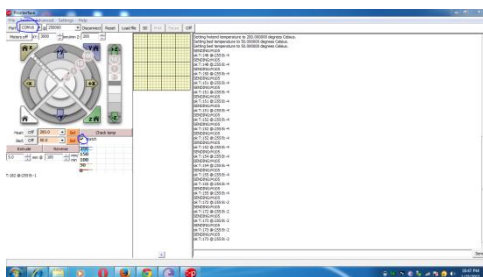
Urbee the first prototype car 2011 was presented. This is the first car ever to have its entire body printed out on a giant 3D printer.

It has three wheels, and two seats.

- Architecture

Pontefract Software

To compile and upload firmware to your arduino-based electronics, you use the arduino IDE that you can download from the arduino website, By this software we can control the printer.



Working procedure

1. First we have to design in Auto-CAD or any designing softwares.
2. After designing save the file name as .stl .
3. By using slicer software we have to convert .stl file to g-code file.
4. Now open pronterface software
5. Select the port and speed and click on connect button.
6. Now printer is online we see the display which can seen.
7. Now set the Extrusion Temperature will be 210c for ABS or 160c for PLA (Do not go above 225c)
8. Check the printer it is in good condition or not.
9. Then upload g-code file in pronterface software



Food processing:

FOOD PREPARATION

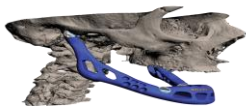


© In food preparation, to apply items in liquid or paste form such as cheese, icing, and chocolate.

➤ Medical Industry

© Physicians can use 3D printing to make hearing aids, artificial teeth, and bone grafts.

3D printed Jaw



➤ Complex Structure



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.

Disadvantages

- ☺ Since the technology is new, limited materials are available for printing.
- ☺ Consumes more time for less complicated parts.
- ☺ 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.

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.

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.

The US Army has also experimented with a truck-mounted 3D printer capable of outputting spare tank and other vehicle components in the battlefield.

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 Visions gallery.

CONCLUSION

This paper describes that 3D Printing technology could revolutionize and re-shape the world. Advances in 3D printing technology can significantly change and improve the way we manufacture products and produce goods worldwide.

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I would like to dedicate this paper to my parents Smt & Sri Sujatha Narsing Rao garu

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