

CNC BASED MULTIFUNCTION PLOTTER

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Abstract - The motive of the project is to develop the designed profile by using CNC machine. The profile designed is needed to write a CNC program based on G-Coding, mode of program is selected because the programming is too easy even for complicated shapes. CNC's had made revolutionary changes with in the manufacturing sector in before days achieving productivity up to the desired level was not possibilities due to lots of drawbacks like complication of shapes and sizes, lack of skilled labours, lots of wastages and scraps due to unexpected mistakes and low quality levels and accuracy. By using CNC this all draw backs can be overcome and this was our small contribution to show the performance of CNC. The invention of the X-Y plotters is to plotting two dimensional data on a rectangular coordinate system. This XY plotter by using mechanism from scanner and microcontroller system (Arduino) to control the movement of XY axis. Modeling and analysis on X-Y plotter is done by the computer linked with the arduino software. It is executed by the G-Code and Java programming with the algorithms.

I. Introduction

There are a many number of plotters are available like: a drum plotter draws on paper wrapped around a drum which turns to produce one direction of the plot, while the hot end move to provide the various direction, a flatbed draws on paper placed on a flat surface; and an electrostatic plotter draws on negatively charged paper with positively charged toner. Plotters were the first type of printer that could print with 3D and 2D also and render graphics and full-size engineering drawings. As a rule, plotters are much more expensive than printers but this machine can solve the variation of the cost. They are most frequently used for CAE applications, such as CAD(computer-aided design) and CAM. Hewlett- Packard is the leading vendor of plotters worldwide.

The project developed is to cover the multifunction in a particular machine using the multi software like java, G- code for coding the machine for plotting the sketch provided through interfaces. The CNC application that installed through the guidance can work platforms like CAD. The functions covered by the project includes milling, laser cutting, 3d plotter and pen plotter.

CNC based multipurpose plotter is machine which works in a way of controlling how machine tools operate using a computer. This machine tools have revolutionized manufacturing because they are working in the concept of CNC, not by people. CNC operators has experience in numerical control programming may advance to the job of tool programmer. A CNC plotter is a printer that interprets commands from a computer to make line drawings on paper with one or more automated pens and also draws a 3D model. Unlike a regular printer, the plotter can draw continuous point-to-point lines and 3D models directly from vector graphics files.

II. Existing system

Milling and drill machines are popular machines in mechanical engineering. Milling is very important in mechanical processing. It may, however, be unnecessary and expensive for some companies of small or medium sizes to acquire one for their own use. This research aims at analysing and designing a milling/drill machine based on an existing drill machine available in workshops. The main approach is to study technical features of the existing drill machine, calculate and design the milling machine from the basic parameters as cutting force and power of drill machine. Based on the technical requirements for the design, which are represented in assembly

drawing, the improvement in the function was briefly shown in different steps. Cutting force is calculated using the feature of a drilling machine, which is 6415

M. Milling machine is designed with six levels of feed rate for manufacturing process, which are 63, 90, 125, 180, 250, and 335 mm/min. With a 0.037 kW motor, the revolution after the gear reduces is 60 rpm. Once the calculations of gear, lead screw, speed and capacity of the motor have been completed, the feed rate is determined. Gear box is designed with transmission units, which can provide 6 levels of feed rates as required when they are in combination. The outcome of this research is a milling/drill machine that has been theoretically designed and calculated. The assembly drawing, which can meet the technical requirements, can be applied to real drill machine. An approach is provided to improve (and design) a drill machine into an ideal drill/milling machine to be used by small or medium sized companies.

Laser cutting is a technique that uses a laser to cut materials accurately. Laser cutting works by directing the output of a high-power and effective laser, by computer, at the material to be cut. The material may be thin then either melts, burns, vaporizes away, or is blown away by a jet of gas, leaving an edge with a high-quality surface finish. Industrial laser cutters are mostly used to cut the flat-sheet material which is bit harder. Benefits of laser cutting over mechanical cutting is easy completion of work and reduced consumption of workpiece where there is no cutting edge which can become consumed by the material. Precision may be better, since the laser beam does not wear during the cutting. There is also a reduced chance of warping the material when it being cut, as laser systems have a small heat-affected zone. Some materials are very hard or impossible to cut by more traditional methods.

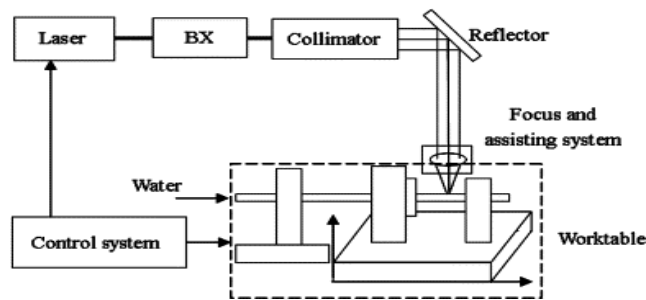


Fig. 2.1 Architectural Diagram

3D printers are a recent generation of machines that can make things easy. They're remarkable because they can produce different kinds of models, in different materials, all from the same machine. A 3D printer can make much better thing from ceramic cups to plastic toys, metal machine parts, stoneware vases, fancy chocolate cakes or even human body parts. They replace classic factory production lines with a single machine just like home printers replaced by ink, a printing press, hot metal type and a drying rack. 3D printing is a type of additive manufacturing technology where a 3D object is made by laying down successive layers of material which forms the final three dimensional objects. 3D printers offer designers the ability to build parts and components that are made from different materials like plastic and ceramic. Which have various properties in a single build process. The more advanced 3D printing technologies currently yield models that closely emulate the appearance and functionality of the final product which is more accurate. 3D printing is done using an additive technique, where successive layers of material are built down in different shapes as lines. 3D printing is also considered from traditional printing techniques, which mostly work on the technique by removal of material such as cutting or drilling of an material.

2D plotter is a development of the X-Y plotter is to scheming two dimensional data on a rectangular coordinate system. XY Plotter prints by moving a pen across the surface of a paper. This project is to operate drawing the 2D image or font by the machine. By using this XY Plotter, can draw the complex art and including text. The result is very accurate. This project mainly uses three software: CorelDraw, Lazy CAM and Mach 3

milling. Based on G-code command the required outputs can be loaded into the machine. The main components are stepper motor, TB6600 driver, Parallel Port, Mach3 interface card and other mechanisms. This research project controls the movements with the electronics pulse and also by the CNC coding. The model XY- Plotter is achieved by drawing the picture or by lettering the desired text with a resolution of 0.005mm with accuracy.

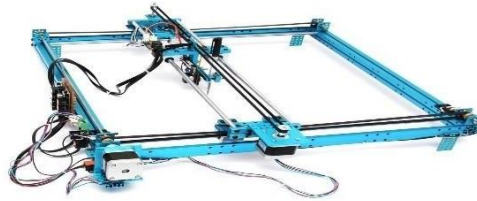


Fig. 2.2 2D -Plotter

III. Proposed system

The proposed system is developed based on the 2d plotter. Which rely on CNC. The multifunction carried out by the machine is sketching, milling, plotting, drawing, laser cutting and 2d printing. The dimensions covered by the machine is x axis, y axis and z axis, the x and y axis range covered by the plotter is 400mm x 400mm in a rectangular path, the z axis covers altitude of range 50mm to 80mm, **2d plotter** uses multidimensions including x, y and z axes. software handled for 2d plot **GRBL Controller. 2d printing** is made to function by installing the software called **REPRAP1.4 Controller and CURA. Laser cutting** function in the machine can be made achieved using the multiple software combined and integrated is **GRBL Controller, REPRAP1.4 Controller, CURA. Milling** function can be performed by the machine by installing the software **GRBL Controller.**

IV. Implementation

The first step in designing a model in 3D printing is the same as designing it for CNC plotter: Engineers use a 3D modeling program to construct a solid body. In many cases, the 3D model designed for a machining process can be reused for 3D printing, although engineers experienced in 3D printing often make minor changes to ensure 3D printing is more efficient. After the design is complete, the model is commonly exported from the CAD program in “.STL” file format, an standard. CAM is not required for 3D printing. Instead, the equivalent of toolpath generation is performed by a program called a “slicer” Nearly all professional 3D printers include easy-to-use slicer software for generating codes. It slices the part into many separate layers, and then generates toolpaths and machine code, which is used by the 3D printer for print a model. With some machines, the machine code is loaded to the printer via a thumb drive or USB cable. Other machines are connected to computers using Wi-Fi or Ethernet over an office or shop network. Still others are using internet-enabled applications and let users print from home or on the road by the go. Although there are many types of 3D printing processes, available in professional 3D printing, today use one of two fundamental types: thermoplastic extrusion or selective photopolymer curing. Extrusion printers, also called FFF stands for fused filament fabrication printers, are essentially high-precision, robotic glue guns which melt and extrude both common and engineering thermoplastics such as ABS and nylon. Tiny extrusion nozzles moved about by X-Y-Z form the shape of each layers. Photopolymer using printers, called SLA stands for stereolithography, use lasers or light projectors to solidify pools of light- curing epoxy form the part’s layers. Both techniques build up many thin , until 3D part is complete.

Dimensional perfection and resolution are related to printer technology and the manufacturer implementation in codings, but most professional 3D printers are capable for shop role. Here are some real- world examples of 3D printing giving CNC milling boost.

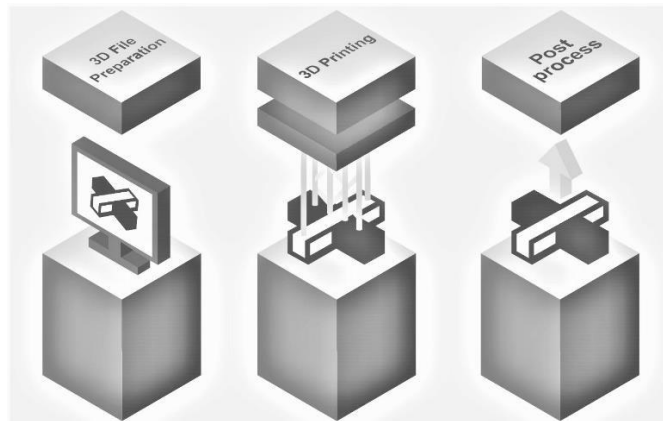


Fig. 4.1 Models

Workholding Soft Jaws: Some fixtures, including soft jaws, include curved or complex surfaces that require surface milling operations with a ball-nose end mill to develop the desired dimension and shape. Only because 3D printing is an additive- manufacturing process, requires no toolpath programming in a CAM package instant using slicer tool, curved surfaces are no more difficult to develop than planar features. All geometry is handled using the software. 3D printers excel at producing these types of fixtures because the relative complexity of a part's dimension generally does not affect the printing time for fixtures or any other parts of a model.

V. Future enhancement

This project can be developed as a product to sell in the market and also very useful for the small scale industry for their own financial support. The printer can also used for the medical educational purpose with the 3d model of an organs of the body. Future generation can develop this product into a massive artificial intelligence device to print the model by just telling the requirements of the customer.

VI. Conclusions

The CNC based multifunction plotter with the multi- functions like cutting, drawing and developing the models in the 3D is a promising product in a market. This project deals with the quality outcomes with the benefits of errorless and accurate prints and models for the customer who deals with the models. This CNC based multifunction plotter is the convenient project in the size and the cost wise also. This plotter will be the eye opener for the 4th generation of industry. The peoples who wants to present their project to their customer will be attracted with this project and peoples will definitely shows their interest to the revolutionary project. 3D-Printing is seeing significant growth. At present the majority of this is based on product prototyping, but truly digital additive manufacturing is now taking place. The main sectors are for low volume parts with high value added such as in the aerospace and medical sectors. Some take-up is now happening in the electronics manufacturing and packaging sector and a number of organisations including 3D-Printer suppliers, Materials suppliers, EDA vendors and CAD companies are seeing 3D-Printing for the electronics sector as a major opportunity. But challenges in terms of materials behaviour, performance, reliability and design tools still need to be addressed.

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