Design and Fabrication of Mini CNC Plotter

M.Kumar[1], K.Rajan[2]

[1,2]*Lecturer senior Grade, Department of Mechanical Engineering, Murugappa Polytechnic College, Chennai*

Abstract- **In this research work is to design a low cost CNC plotter. Due to rapid growth of technology the usage and utilization of CNC machine in industries are increased. The plotter is a computer printer for printing computer graphics. It gives a hard copy of the output.it can draw complex line art, including text, but do so slowly because of the mechanical movement of the pens. In this project we are using user- friendly software called PLOTBOT instead of G-CODE. The fabrication of low cost CNC machine is used to reduce the cost and complex of machine.**

Index Terms- **CNC Plotter, PLOTBOT.**

I. INTRODUCTION

In today's world the basic requirement of any industry is to produce large quantity and quality products with low production and installation cost having high surface finish and great dimensional accuracy. So this can be achieved by a machines which are controlled by Computer i.e. Computerized Operated Machines. They are basically known as CNC machines. By using a CNC machine the products are produced at a faster rate with high accuracy and less human interference. The CNC machines usually are of various types. The most common used CNC machines are two-axis CNC machine and three-axis CNC machine.

The CNC machine is a system. This system consists of three important parts viz. Mechanical design, Drive modules, and System software. The mechanical design consists the body of the system. The drive module consists of the Microprocessor. And finally the System Software is used to generate the drawing on the sheet.

Mini CNC Plotter Machine is the automation of machines that are operated by precisely programmed commands. The main function of CNC Plotter is used for plotting various drawings of products. The working principle of CNC Plotter is very similar to CNC machine. In this system instead of plotting the drawing of product by hand, it is plotted by a computer controlled pen. It produces a high quality work as compared with the human work. Automation and precision are the main advantages of CNC Plotter table. In this project we will show how to build your own low cost mini CNC Plotter.
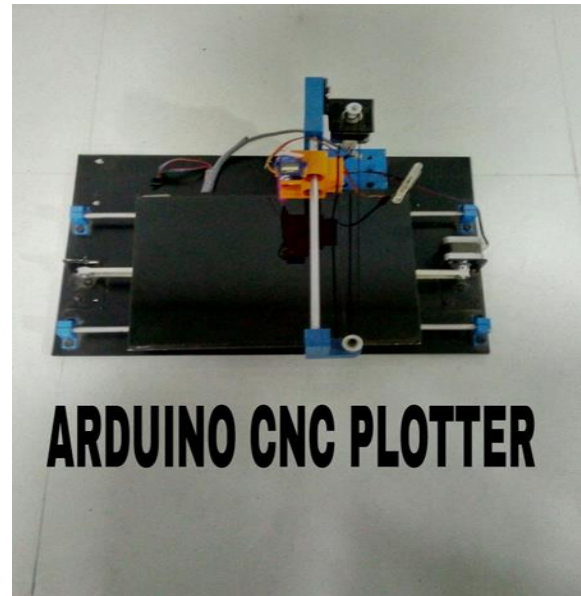
II. MAIN COMPONENTS

Figure.1 ARDUINO CNC PLOTTER

a.Stepper Motor

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.
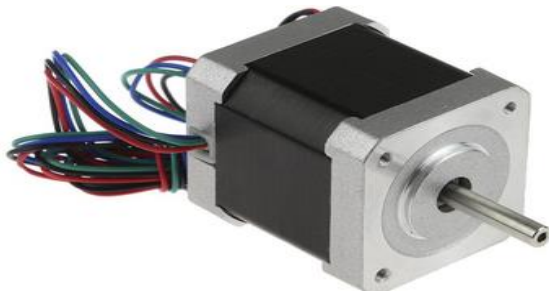
Figure.2 Stepper Motor

b. Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

Figure.3 Servo Motor

c. ARDUNIO NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the ArduinoDuemilanove, but in a different package.It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.TheArduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin

27). The power source is automatically selected to the highest voltage source.
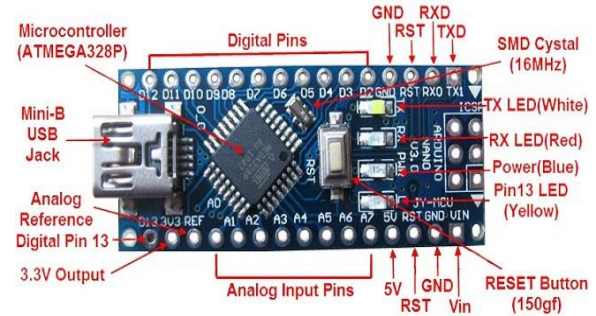

Figure.4 ARDUNIO NANO

d. DRV8825 Controller

it is a micro stepping bipolar stepper motor driver features adjustable current limiting, over current over temperature protection, and six micro step resolution(down to 1/32 step).
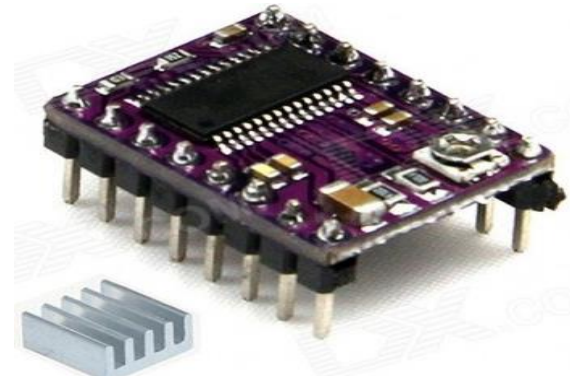

Figure.5 DRV8825 Controller

e. Linear Bearing

A linear-motion bearing or linear slide is a bearing designed to provide free motion in one direction. There are many different types of linear motion bearings.

Motorized linear slides such as machine slides, XY tables, roller tables and some dovetail slides are bearings moved by drive mechanisms. Not all linear slides are motorized and non-motorized dovetail slides, ball bearing slides and roller slides provide low-friction linear movement for equipment powered by inertia or by hand. All linear slides provide linear motion based on bearings, whether they are ball bearings, dovetail bearings, linear roller bearings, magnetic or fluid bearings. XY Tables, linear stages, machine slides and other advanced slides use linear motion bearings to provide movement along both X and Y multiple axis.

Figure.6 linear Bearing

f. Base Plate

The base plate can be fabricated manually. Its thickness ranges from (1mm-3mm). All the components of the plotter are mounted accurately on this base plate.

g.GT2 Timing Belt

Timing belts are a fantastic way to transfer rotational motion (from a stepper motor) into linear motion (along a rail) and these GT2 belts are excellent for the task. They have a special profile with rounded teeth which reduces backlash. Often used for precision 3D printers and CNC machines.

Figure.7 GT2 Timing Belt

h.Idler Pulley

It is guide to tightening pulley for a GT2 timing belt.

Figure.8 Idler Pulley

i. Jump Wires

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Figure.9 Jump Wires

j. Plotting Board

It is board made up of acrylic glass which is fabricated manually. The plotting paper mounted on this board.

k. Vertical Channel

It is a channel which is mounted on the base plate vertically. It is used to support the sliding channel for x-axis.

l. Plotting Pen

This is a small pen enables you to write, draw or simply set markers with your CNC machine. The pen has a clamping surface of ⌀20mm. it can easily be clamped with our adequate ⌀ 43-20 mm adapter. Thanks to the cushioned lead, it creates a consistently good typeface. The spring power can be adjusted via the hand screw.

III.SOFTWARE

The computer system consists of the software. The software used for plotting is "ENSCAPE Software". This software converts thediagram into PLOTBOT and then stored the data in the Arduino circuit. Then

the input from Arduino circuit plots thedrawing on the sheet.

IV. CONCLUSION

The design and fabrication of Mini CNC plotter reduces the overall cost of the machine. The factors reducing the overall costs are reduced human efforts, less time to finish the work, identifying the tool movement of CNC and reduced tool movement error. This plotter are perfect for CAD technical drawings, project blue prints etc. Mini CNC Plotter has less error than the conventional type plotter.

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