CNC PCB PLOTTER

[1]Anjali Kumari, [2]Janhavi Pathak
[1]Student , [2]Student
[1] ENTC DEPARTMENT,
[1]AISSMS IOIT, Pune, INDIA

Abstract : - At basic level a CNC machine influences an established coordinate system's results to perform the given set of tasks using a computer which are given by an operator. CNC machines are mainly used in settings in industries, whereas an example which is present and used in daily life is a printer.In order for a printer to deposit ink on a piece of paper, it needs the instructions from an operator. The operator tells the computer what they want to print and the computer sends that information to the printer in a way the printer can understand.Our project deals with a kind of CNC machine which is going to print the given PCB layout on a board. In today's rapid growth of technology manufacturing of low cost machine is important to reduce cost and complexity of the machine. This low cost machine can be achieved by incorporating the features of PC with ATMEGA328 microcontroller. We have used a G code to instruct different parts of the CNC machine. G code is the mathematical instructions given to the controller to run different parts of machine.

IndexTerms - CNC, PCB, G-code, ATMEGA328, ARDUINO.

I.Introduction

A plotter is a special type of printer that prints using a pen on the solid surface. In computer numerical control (CNC), microprocessor is used which is capable of processing logical instructions interfaced with a computer. This logical instruction is provided in the form of G code to the microcontroller.This low cost machine will be beneficial for students in electronics in educational area to build their own PCB anytime anywhere quickly at a very low cost. CNC machine are used in manufacturing areas that involves the use of computers to control different machine tools. CNC is short for computer numerical control. Our project is inspired by combining the features of both plotter and CNC machine to make a small CNC pcb plotter. The idea behind our project is to make a CNC machine which draws the given image or picture on a solid surface which can be a plywood or anything. It uses two stepper motor for x and y axis and a servo motor for controlling the pen on the z axis. The synchronization of these three motors which is two stepper and one servo motor is very much important.This is achieved using the inkscape software to provide G code to the different machine parts.The CNC machine plotter is a 3D controlled 2D plotting machine which uses a pen to draw text or an image on the solid surface.

II.METHODOLOGY

A CNC plotter is able to draw complex line drawings. The coordinates are uploaded to the machine controller by a separate program. The image file is transformed into a G-code via Software. Then the code is transferred to the microcontroller by which the motor mechanism is instructed to draw the image. In this project, we are going to present a simple design for a CNC plotter. Our idea is an Arduino based design using ATMEGA 328P microcontroller.

The machine will have three motors to implement the X, Y, and Z axis. A servo motor will be used along the Z axis for positioning the pen which will go up for logic 0 and down for logic 1[1]. Drawing will be done on the X-Y plane where the positioning will be controlled by stepper motors.

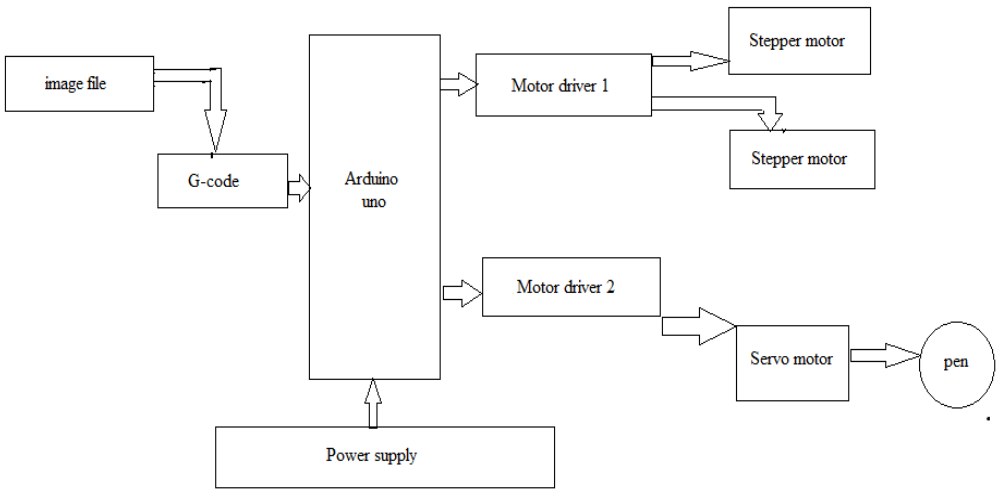

Fig 1. Bock Diagram

In this idea of project, Arduino microcontroller platform with ATmega 328 core is used. It can be easily interfaced with PC whereas also with the easy drivers and stepper motors and servo motors to. Arduino microcontroller-Stepper motor positions are controlled by using arduino microcontroller.It has an open source prototyping platform which is based on easy to use hardware and software. They have digital and analog input/output pins that can interface into various expansion boards and other circuits and an Atmel 8, 16 or 32-bit AVR

microcontroller with complementary components that helps in programming. Arduino programs are written in any programming language with a compiler that produces binary machine code.

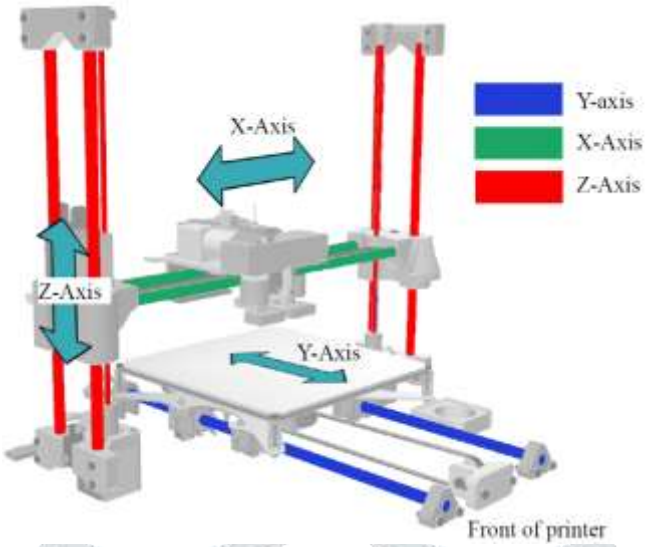

Fig 2. Axes prototype

IV.COMPONENTS USED

Arduino Uno

ATmega 328 is a microcontroller based on AVR RISC (Reduced Instruction System Computer) and combines 32KB ISP flash memory with read while capablities. Operating voltage is 1.8-5.5Volts. processing sepeed and consumption of power by executing powerful instruction in one clock cycle.

Fig 2. Arduino Uno

Stepper motor

A stepper motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation in a number ofequal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller) .ANEMA 23 stepper motor is a stepper motor with a 2.3 x 2.3 inch size is chosen to drive the motion of the axes. NEMA 23 stepper motors are high torque about 19KG-Cm holding torque .NEMA 23 stepper motors have 1.8 degree step angle with 2.5A rated current. The speed of rotation is directly proportional to the pulse frequency .The higher the output voltage from the driver, the higher the level of torque drive

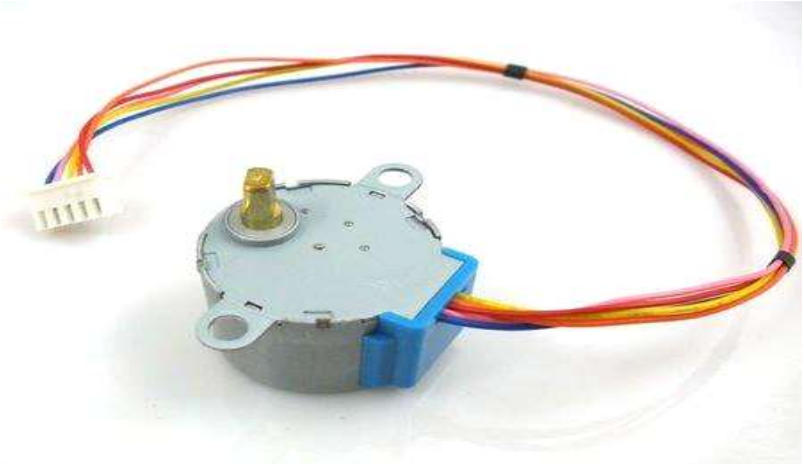

Fig 3. Stepper motor

Servo motor

80-base series AC permanent magnet servo motor is universal-type AC servo motor developed by INVT. The power range is 200W~15kW, which can fully satisfy the function demands of general industry robots. It is widely applied in electronic manufacturing devices, digital control devices, packaging machinery, printing machinery, textile machinery, plastic machinery, glass device and test device, etc.

Fig 4. Servo motor

V. LIMITATION

The machine runs in a slow pace and generates excess heat which causes the heat sink to be heated quickly. A slight error may remain on the image file after it has been plotted due to one side of the Y-axis fixed to the moving mechanism and the other end is free to move. The Z-axis is not very rigid so it causes slight vibration.

VI. FUTURE SCOPE

The pen of the machine can be replaced by a laser to make it work like a laser engraving or cutting machine. Engraving machine can be used on wood. The pen can also be replaced with a powerful drill so that it can be used for both milling and drilling purposes. The servo can be replaced with a stepper motor and the pen with a 3-D pen to make it a 3-D printer which can print objects with dimensions. By extrapolation of the axes, the working area of the machine can be extended keeping the algorithm unaltered.

VII. CONCLUSION

The communication of G –code with arduino uno provides more accuracy and reduced load on hardware. The coodinates of the stepper motor and servo motors are found out with the help of a Graphical Code. This helps in allocation of motors position on computer which can be seen through its motion on the board which can start and stop anytime whenever required. This low cost cnc machine is affordable and flexible.

VIII. REFERENCES

1. Aneeta Pinhiero, Beljo Jose, Tinsemon Chacko, Nazim TN, “Mini CNC Plotter” in International journal of innovative research in electrical, electronics, instrumentation and control engineering vol. 4, issue 4, april 2016.
2. Dr M Shivakumar, Stafford Michahail, Ankitha Tantry H, Bhawana C K, Kavana H, Kavya V Rao, “Robotic 2D Plotter”, International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 10, April 2014.
3. Mohammad Kamruzzaman Khan Prince, Muhsi-Al-Mukaddem Ansary, Abu Shafwan Mondol, “Implementation of a Low-cost CNC Plotter Using Spare Parts”,International Journal of Engineering Trends and Technology (IJETT) – Volume-43 Number-6 -January 2017.
4. Kajal J.Madekar, Kranti R. Nanaware, Pooja R. Phadtare, Vikas S. Mane, “Automatic mini CNC machine for PCB drawing and drilling”, International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 02 | Feb-2016.
5. Anjali k m, Niveditha p s, p Shyama, Sreeja sreedharan v, susmi p s, “pcb plotter and retracer”, international journal of industrial electronics and electrical engineering, ISSN: 2347-6982 volume-4, issue-5, may.-2016