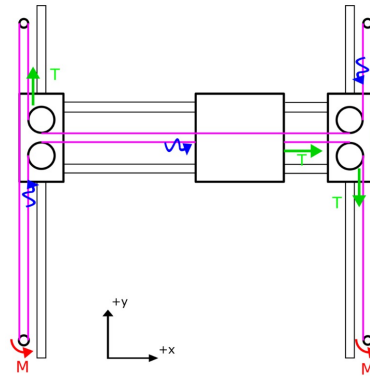


Design Lab



CNC Plotter

A computer-controlled device used for drawing or plotting complex designs or patterns on various surfaces such as paper, fabric, and other materials.

Team members:

Aakriti
Sanju Kumar

Supervisor:

Dr. Saurabh Kumar Pandey
Professor, EE Dept.
IIT PATNA

October 4, 2023

Abstract

With the advancement of technology, demand for Computer Numerical Control (CNC) plotter machines in Educational Institutions and Laboratories is rapidly rising. CNC (Computer Numerical Control) drawing machines are computer-controlled devices that use automated software to control the movement of a pen or other drawing tool. We have used pen instead of mechanical tools like drilling, grinding, machining etc. These machines are used to create precise and intricate designs on various surfaces such as paper, fabric, and other materials. CNC drawing machines have revolutionized the way we create art, design, and engineering products.

Acknowledgements

We would like to express my sincere gratitude to our supervisor, Dr. Saurabh Kumar Pandey for accepting our project proposal and guiding us throughout the project. Your valuable feedback, constructive criticism, and encouragement were instrumental in shaping this project and bringing it to fruition.

We would also like to extend our heartfelt thanks to our friends for their invaluable support in recording the demonstration videos and making this project a fun and memorable experience. Their enthusiasm, creative ideas, and technical expertise made this project all the more enjoyable and rewarding.

Finally, we would like to thank Tinkerer's Lab for providing us with the resources, facilities, and opportunities to pursue this project. This project would not have been possible without their support and encouragement.

Contents

Abstract	ii
Acknowledgements	iii
1 HARDWARE ASSEMBLING	2
1.1 Hardware	2
1.2 The Circuit	3
2 METHODOLOGY	4
2.1 Main parts of CNC plotter	4
2.2 Block Diagram of Process	5
3 SOFTWARE	6
3.1 Uploading the code	6
3.2 Making our own G code file	6
3.3 Sending G code to CNC Machine	6
4 CONCLUSION	7
4.1 Applications	7
4.2 Advantages	7
4.3 Disadvantages	8
4.4 Conclusion	8

Chapter 1

HARDWARE ASSEMBLING

1.1 Hardware

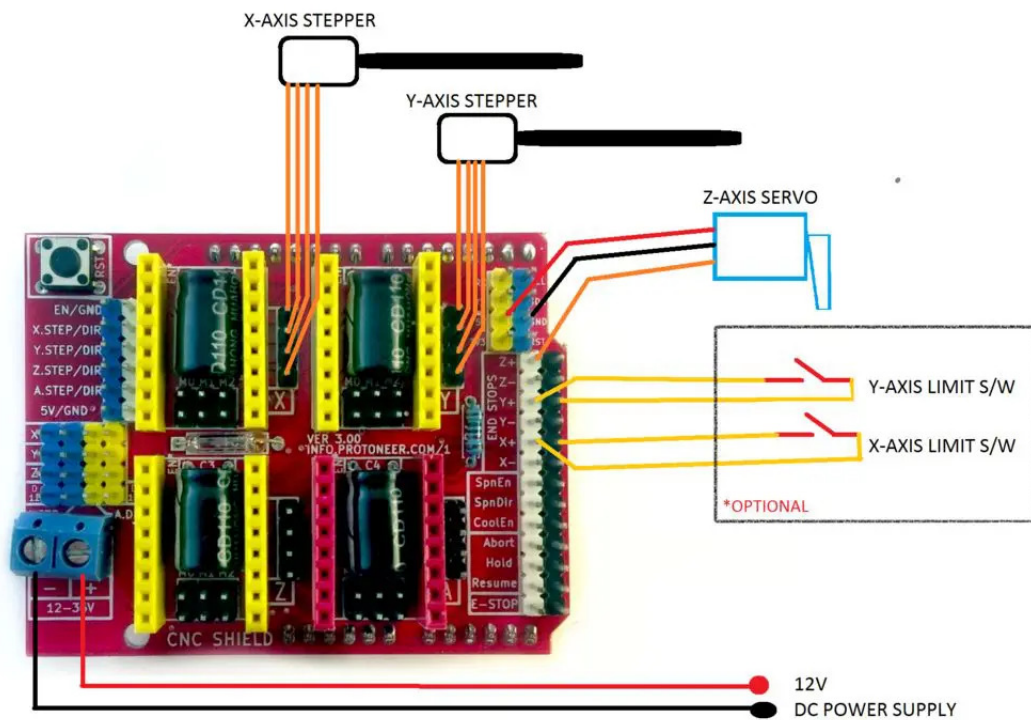
The following hardwares are used to construct CNC machine :

- 2 x NEMA 17 Steppers 1.8 Degree Step 12v Torque more than 4kg/cm
- 2 x 8mm,10mm Stainless Steel Smooth Rods
- 2 x LM8UU 8mm,LM10UU 10mm Linear Bearing or SC8UU 8mm, LM10UU 10mm Linear Bearing
- 4 x SK8 8mm,SK10 10mm Rod End Support
- 4 x LM10UU 10mm Linear Bearing or SC10UU 10mm Linear Bearing
- 2 x 20-Tooth GT2 pulleys
- 12 x F623ZZ Bearings
- 1 x Micro Servo SG90
- 1 x Arduino UNO
- 1 x CNC Shield V3
- 2 x Pololu Step Sticks A4988 Stepper Driver
- 1 x GT2 Belt (3 meters long)
- 1 x Hard Wood Ply 50cmx60cmx1.5cm
- Multiple screws with nuts

- 1 x Wire 5m
- 1 x SMPS 12v 5A
- 1 x Soldering Wire
- 1 x Solder
- 1 x Jig Saw
- 1 x Jig Saw Blade for wood cutting
- 1 x USB Wire
- 1 x PEN

1.2 The Circuit

Now we build the circuit and test stepper motors (X and Y axis). The below image shows the breadboard circuit schematic. In next step, the testing for x and y axis is done. If the steppers doesn't work properly, we must find correct working combination by changing the cables between them and the L293D IC.

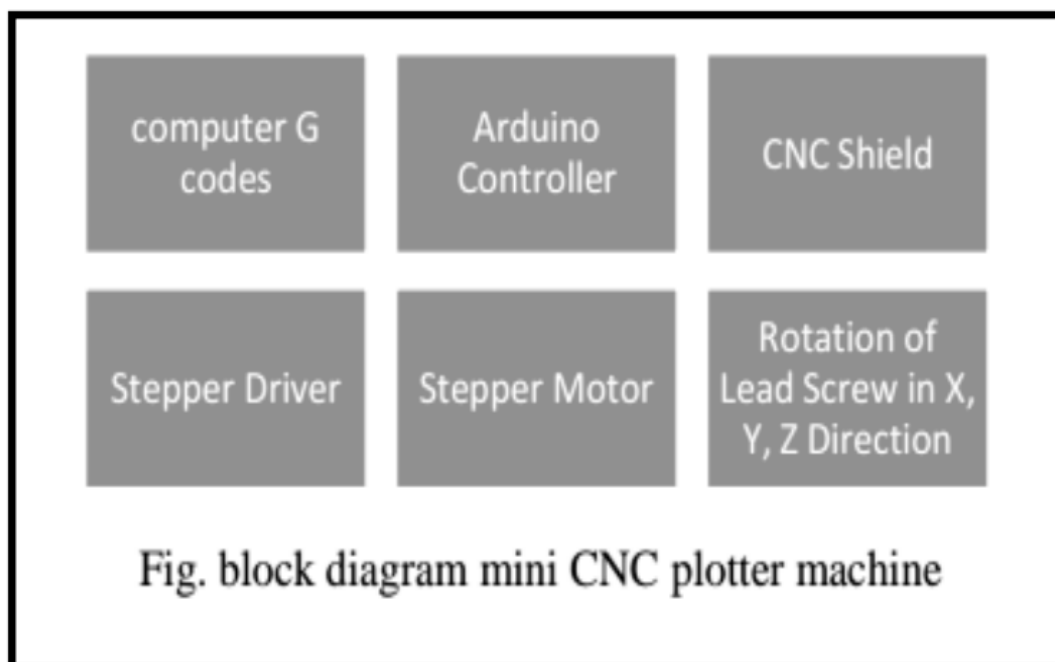


Chapter 2

METHODOLOGY

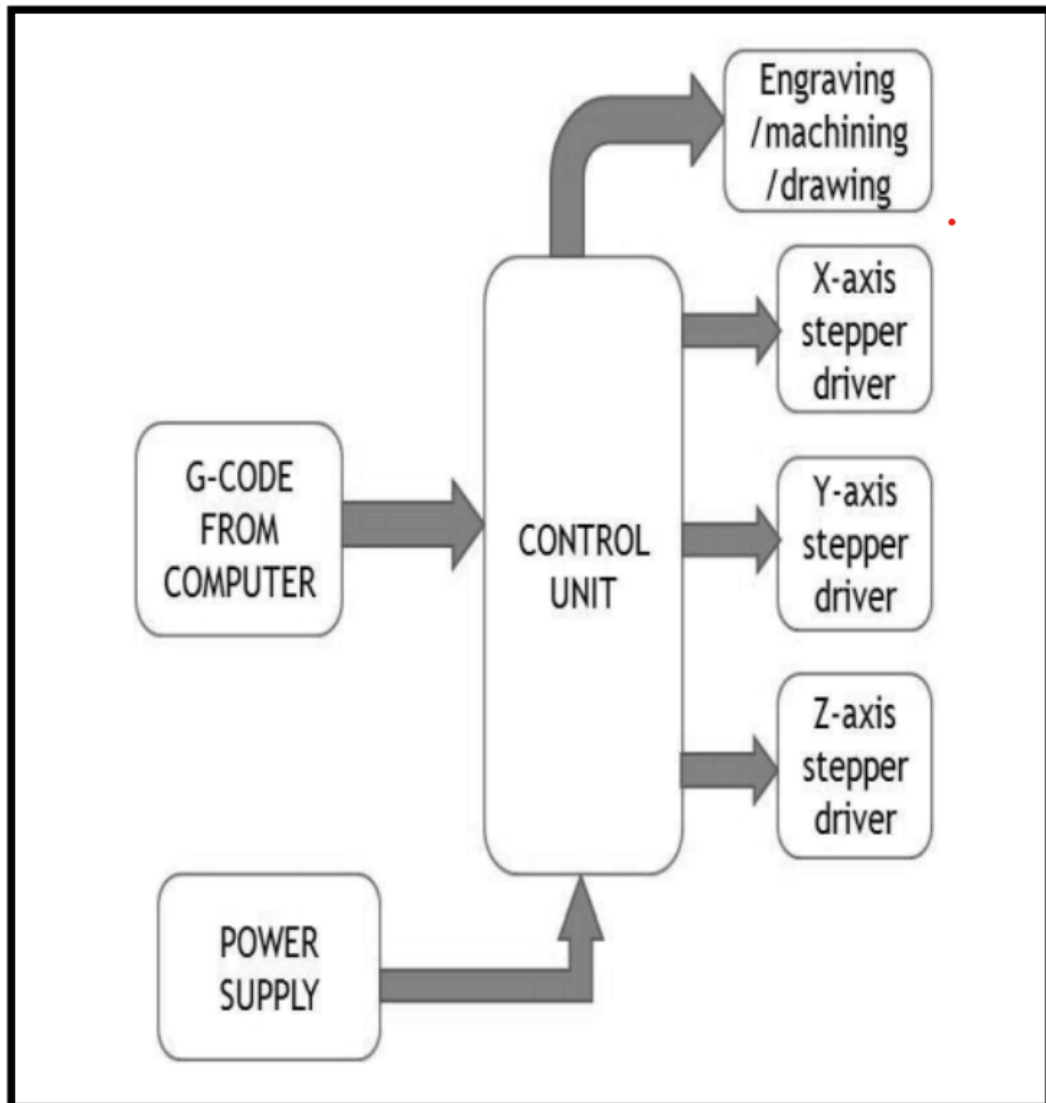
2.1 Main parts of CNC plotter

Mini CNC Plotter Machine is worked on input as a G codes of design and converting it via use of Arduino, Stepper Drivers, CNC Shield, Stepper Motor in to a rotation of lead screw. We have work on to maintain lowest cost of our project. We have design a simple construction of our project. This is easier way to use stepper motor with lead screw, CNC shield, Stepper drivers, Arduino Board, etc. The setup of machine is flexible thatâs why it will be easily transported and maintenance time is short. The basic diagram of CNC Plotter machine is shown in figure.



2.2 Block Diagram of Process

In this idea of project, Arduino micro controller is used which can be easily interfaced with PC. The G-Code from computer is fed to the control unit i.e, Arduino and it controls stepper motors and servo motor.



Chapter 3

SOFTWARE

3.1 Uploading the code

We have used Grbl library which accepts standards-compliant G-Code to draw various shapes such as arcs, circles, helical motion, etc. It also includes full acceleration management with look ahead so as to deliver smooth acceleration and jerk-free cornering. The program is uploaded to the arduino using Arduino IDE.

3.2 Making our own G code file

To make g code files that are compatible with this CNC machine we have used the Inkscape software. It is used by design professionals and hobbyists worldwide, for creating a wide variety of graphics such as illustrations, icons, logos, diagrams, maps and web graphics. Inkscape uses the W3C open standard SVG (Scalable Vector Graphics) as its native format, and is free and open-source software.

The image we want to draw is uploaded to the Inkspace software and then exported as g-code file which will be used to send commands to the CNC machine.

3.3 Sending G code to CNC Machine

Universal Gcode Sender (UGS) is a software application which is used to control CNC machines through G-code commands. It is first connected to the Arduino and then the G code file is uploaded. In the next step, the UGS 'run' command is executed which sends each G code line one by one.

Chapter 4

CONCLUSION

4.1 Applications

CNC drawing machines have a wide range of applications, including:

- **Art and Design:** CNC drawing machines are used to create complex and intricate designs on various surfaces such as paper, canvas, and wood. Artists use CNC drawing machines to create large-scale murals or detailed sketches.
- **Architecture and Engineering:** CNC drawing machines are used to create precise blueprints and schematics for architectural and engineering projects. This helps to save time and reduce errors in the design process.
- **Sign Making:** CNC drawing machines are used to create custom signs with high precision and consistency. This is particularly useful for businesses that require large volumes of signs, such as retail stores and restaurants.
- **Textile Industry:** CNC drawing machines are used to create complex patterns and designs on fabrics, such as embroidery or applique. This is useful for creating custom clothing or other textile products.

4.2 Advantages

CNC drawing machines offer several advantages over traditional manual drawing methods, including:

- **Precision and accuracy:** CNC drawing machines are able to create precise and accurate designs with consistency.

- Speed: CNC drawing machines are able to complete complex designs quickly and efficiently.
- Versatility: CNC drawing machines are able to work on a variety of surfaces and materials.
- Reduced errors: CNC drawing machines are less likely to make mistakes or errors than traditional manual drawing methods.

4.3 Disadvantages

CNC drawing machines also have some disadvantages, including:

- High cost: CNC drawing machines can be expensive to purchase and maintain.
- Complexity: CNC drawing machines require specialized training and knowledge to operate effectively.
- Limited creativity: CNC drawing machines are limited by the designs that are programmed into them, which can limit creativity.

4.4 Conclusion

CNC drawing machines have revolutionized the way we create art, design, and engineering products. They offer several advantages over traditional manual drawing methods, including precision, speed, versatility, and reduced errors. However, they also have some disadvantages, including high cost and complexity. Despite these limitations, CNC drawing machines are a valuable tool for creating precise and intricate designs on various surfaces and materials.