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CNC PLOTTER MACHINE

Mayur Panchal,

Department of Mechatronics Engineering New Horizon Institute of Technology and Management, India

ABSTRACT

This study presents a method for automatically converting any text or image to a 2D plotted text or image using a CNC plotter. The method is based on an Arduino Uno and a motor driver IC. CNC-based technology is more and more prevalent today. The cost and complexity of machines have decreased with the development of affordable CNC machines. The project's goal is to create a CNC 2D plotter that is quicker and less expensive than existing models.

Keywords: Computer Numerical Control, Algorithm, Arduino UNO, Machine Language, Arduino Drivers, G Codes

I. INTRODUCTION

Education uses technology on a daily basis. The cost of advanced technologies is prohibitive. Due to the accessibility of computers' hardware-software interface and their softer nature, visualization and verification have become less challenging since the time when they were first introduced to education. Low-cost robots have a wide range of uses in the classroom. To create two-dimensional digitally controlled plots, plotters are frequently used. This CNC machine for 2D plotting can be swapped out for more specialized laser sources that can cut a variety of materials with varying strengths in 3D plots. A rectangular coordinate system is used by the 2D plotter to store and display two-dimensional data. Because they can process logical commands via computer interfaces, the Arduino Uno microcontroller and L293D motor driver are used in computer numerical control. A CNC plotter is a 2D plotting tool that uses 3D control to use a pen to write or draw on any solid surface. The CNC system is programmed using G-code programming. G-code is a function that instructs the machine where to turn on and off, as well as how quickly it should move to various locations. The microcontroller was helped by the Arduino system's affordable and user-friendly functionality as it built the circuitry for the 2D printer's printer.

II. METHODS AND MATERIAL

We transferred data from a computer to the Arduino board via a USB DATA cable in order to supply the current to Arduino while using three stepper drivers to sequentially supply the G codes to the stepper motors. The Arduino board will be supported by the CNC shield. The CNC shield will distribute current in accordance with Arduino's instructions. G code commands are converted into digital pulses for stepper motors by the CNC shield. Three directions will be used to move the stepper motor: up and down in Z, forward and backward in Y. With the aid of this device, we've produced many complex designs. This device produces incredibly accurate results. We have used them in industry to reduce design printing costs because they maintain accuracy. A CNC plotter's drafting and scaling capabilities are very useful.

BLOCK DIAGRAM

The Mini CNC Plotter Machine converts design G-codes into lead screw rotations using an Arduino, stepper drivers, CNC shield, and stepper motor. We still have

work to do in order to keep our project's costs as low as possible. The structure of our project is straightforward. This category includes any stepper motor that has a lead screw, CNC shield, and stepper driver. Consider the Arduino board. The machine's setup is adaptable, making it easy to transport and maintain.

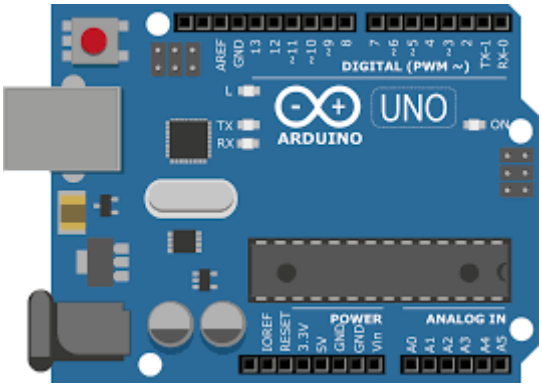
computer G codes	Arduino Controller	CNC Shield
Stepper Driver	Stepper Motor	Rotation of Lead Screw in X, Y, Z Direction

PREPARATORY FUNCTION

This is under "G's" control. G codes are pre-programmed operations in machines that are linked to axis movement. It has two digits and looks like G00, G81, or G90. Each block can have multiple G addresses. Assuming there is no conflict between these tasks. Ex-G02 and Ex-G03 are prohibited because they are in the same block. In a complete design, G functions specify the path to be taken. The following explanations are provided: (G00: Positioning; G01: Linear Interpolation; G02: Clockwise Circular Interpolation; G03: Clockwise Circular Interpolation; and G04: Dwell)

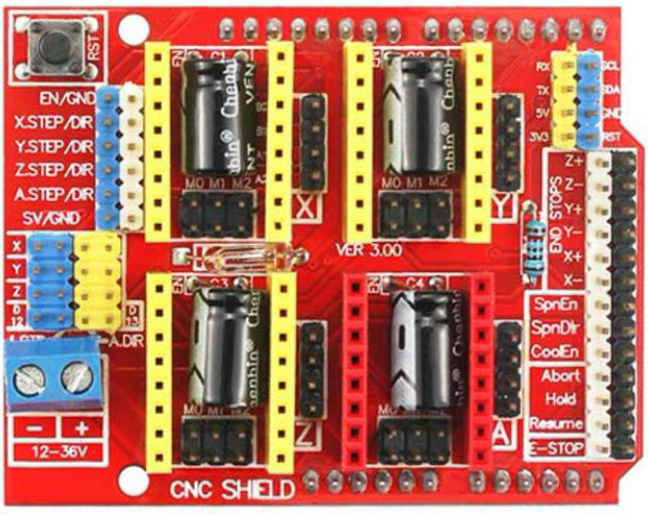
ARDUINO UNO

A device that receives instructions or data from a computer using a USB cable will be referred to as an "Arduino." It is mounted on the CNC shield and transmits data from the Arduino to the CNC shield using a stepper driver. The Arduino UNO microcontroller board only needs to be connected to a computer via USB and a power source to get going. You get everything you need in it. The position of the stepper motor is controlled by a program. It is an open-source platform that was developed with user-friendly hardware and software. A microcontroller with complementary components for programming and integrating into other circuits, as well as digital and analog input and output pins for communication with other circuits, are both included. They are also mounted on an expansion board. A potential difference of 5 volts is delivered by the USB cable.



CNC SHIELD

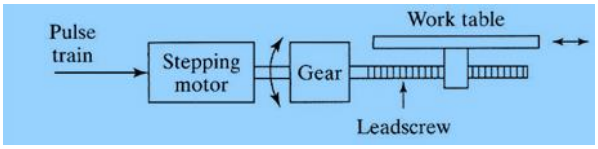
You can quickly set up and run that CNC project with the Arduino CNC shield. It uses open-source firmware to control three stepper motors with the help of three pieces of stepper driver hardware—a breakout board, this shield, and an Arduino. We can build a small, flexible CNC plotter that is simple to use. A SMPS (switched mode power supply) supplies 12 volts to the CNC shield. The CNC shield controls the amount of current sent to each motor. This 4x4 cm bed will be moved by a stepper motor. After lengthening or strengthening the lead screw, I've used this machine to create substantial designs. The CNC shield will monitor the power to all three stepper motors. The CNC machine will take the object's shortest path.



STEPPER MOTOR

A stepper is a device that can convert a digital pulse into pen movement along the X, Y, and Z axes. A stepper motor is a brushless motor that divides a complete rotation into a number of equal steps. The stepper motor is well known for its ability to convert a series of

impulses into a specific shaft position increment. With each pulse, the shaft rotates a predetermined distance. We used 3-stepper lead-screw motors. The rotation of the lead screw with respect to the X, Y, and Z axes will be the result of the screws. The input current supplied by the SMPS is 12 volts.



STEPPER DRIVERS

Three stepper drivers were used to control the stepper motors' X, Y, and Z axes. The Arduino is outfitted with stepper drivers. We supplied a 5 volt input current through a USB cable. The current supply to the stepper motors will be controlled by stepper drivers mounted on the CNC shield. The motor will drive the rotation of the lead screw. The pen's motion will be controlled by a lead screw.

HARDWARE DESCRIPTION

Hardboard, CNC, shield, Arduino board stepper drivers, LEDs, and stepper motors were used on a DVD writer computer. We used 3D printing to make the base parts after designing them in AutoCAD. Any image can be converted in Inkscape first, and then an a.dxf file is created. This dxf file will be converted and generated into G codes using Cambeam. The codes will be assembled using a general-purpose G-code compiler..

Spur gear coding in the form of G codes is used to produce a design on 2D paper. These codes are executed using the software Universal G Code Runner. The general-purpose G code runner will execute G codes in a line. This machine can cut soft materials with a laser beam.

III. CONCLUSION

It has been discussed how CNC machines can be used for simple tasks. Because of the rapid development of this technology, the use and application of CNC machines in industry has increased.

The goal of this project is to create a mechanical model of a CNC plotter device capable of sketching a PCB layout on a specified fixed surface. The precise control of stepper motors enables them to operate with high accuracy and low power consumption. When compared to other CNC products, this project is extremely cost effective. It was built with readily available components and materials. It is intended for use in small educational and domestic manufacturing applications. The device is lightweight and simple to use. It makes use of a straightforward algorithm. For various tasks, a pen head, laser head, or other tool can be used in place of the pen. The software is open-source and user-friendly.

The use of G-code and hardware allows for greater accuracy and less work. We can start or stop the machine at any time because the status of our moving motors can be seen directly on the computer, making it simple to find information about the positions of all moving stepper motors thanks to a compact machine that allows for more flexible work.

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