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ARDUINO BASED 2D CNC PLOTTER

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Abstract:

This model entails the design and construction of a basic three-axis computer-controlled plottable machine. Drawings play an important role in the manufacturing process.

The presence of programmable machine capable of completing the task would make the job much easier. Despite the fact that such drawing machine. Although it may not be particularly useful in the general design and development of parts, it can be a stepping stone in that direction. This project is a fantastic resource for learning the fundamental functions of a robot. In technical terms and by definition, the two are identical. A Plottable machine is essentially the same as a CNC machine. A CNC router, specifically, with a writing ladle tied instead of a cutting tool. This application is an open-source project developed by BCN3D Technologies that anyone can replicate. FDM printers can be used to 3D print the parts. Robot arms are essential for any engineering student interested in working in the manufacturing industry. Robots are now used in almost every manufacturing and assembly process. They perform tasks that are dangerous, strenuous, or too difficult for humans. This paper will present a low-cost CNC plotter machine capable of drawing a circuit layout on a PCB or any other solid surface using a simple algorithm and readily available components. The user must first convert any image or text file into G code using Inkscape software before feeding it to the machine. This project's control device is an Arduino uno equipped with an ATmega328P microcontroller. The microcontroller converts G-code into a set of machine language instructions that are sent to the CNC plotter's motor driver.

Keywords: Arduino, CNC, stepper motors, servo motor, Inkscape software, G-code file are some of the keywords.

Introduction

John T. came up with the idea for the first numerical control (CNC) milling machine in the 1940s or 1950s. This device was used to connect servomotors to a manually controlled machine tool's x and y axes so that a computer could read punch cards to control them and provide positioning instructions. CNC (computer numerical control) machines are crucial in the industrial sector. Each machine has a microprocessor that reads the user-created G-Code software and executes the pre programmed functions. Computer aided design (CAD) and computer-aided manufacturing (CAM) software, which outputs G Code from the users' input of cutters and tool path, are both used by personal computers to design the components and develop programmes. Modern electronics devices use board layouts called printed circuit boards (PCBs).

Literature Survey:

1.Venkata Krishna and Pabolu Alet designed and implemented a two-dimensional CNC machine in the month of November 2010. Creation and Use of a 2D CNC Machine. It elevates the requirement for adaptability and cutting-edge quality. On the.NET platform, visual C# was used in this system. There are three primary categories of computerised numerical controllers in this:1. ASIC-equipped multiprocessor 2. Front end of a computer. 3.A PC and motion control card. This system's layout is user-friendly, provides accurate results, and is adaptable for users. RTOS is extremely expensive, not user-friendly, and also impossible to utilise with such a system.

2.Create a low-cost CNC machine with two axes (2014) Sundar Pandian. Create a low-cost CNC machine with two axes. It is inexpensive and currently utilised in laboratories. Drivers for stepper motors, an open source Arduino board, a microcontroller, and free motor control software. USA-based Zen Tool Works provided the author with a ready-to-assemble kit. Stepper motor, lead screw, guide rod, and spring were included in the kit. He used high density PVC to create the Body. The model gives students more opportunities for hands-on learning, which leads to improved learning results. It was created exclusively for educational purposes.

3.Drawing images and PCB layouts with a CNC machine by Mohammed Khaled Akel, Hisham Fathi Ali, Abdussalam Ali Ahmed, and Abdalla Milad Faraj during 04 May 2022. The need for computer numerical control machines in

businesses is expanding quickly as a result of an increase in workplace accidents, issues with complicated parts produced by traditional machining, such as poor quality and the requirement for lengthy production processes, and technological advancements. The major machinery where computer numerical control is used include lathes, drills, milling machines, etc. The two-dimensional computer numerical control system in this study is capable of drawing images and words and was designed and built in a cost-effective and efficient hardware architecture.

Proposed Methodology:

This project is all about preparing a CNC plotter using the scrap of DVD (movable tray consisting of stepper motors) connected in 3 axis with the help of servo motor in Z direction. Arduino UNO used in this helps the plotter to execute the output by connecting through processing. The main aim for this methodology is to propose a CNC plotter that gives accurate output with less installation of money.

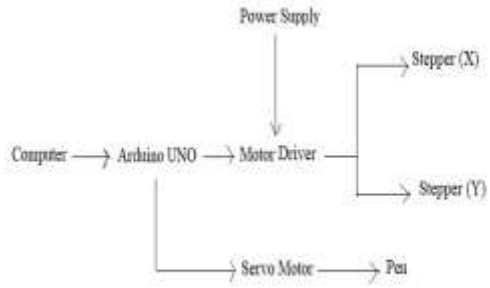

Figure1: Proposed Block Diagram

Figure1 Illustrates how the computer is connected to Arduino and then how the rest of the components will be driven by using the motor driver and external supply provided with a servo motor.

List of components used

1.Arduino UNO
2.CNC Shield
3.Servo Motor
4.Movable Tray with Stepper Motor from DVD
5.power supply (5v)
6.Personnel Computer

Arduino UNO

An open-source electronics platform called Arduino is built on simple hardware and software. A motor can be started, an LED can be turned on, and something may be published online by using an Arduino board to receive inputs like light on a sensor, a finger on a button, or a tweet. Sending a set of instructions to the board's microcontroller will instruct your board what to do. You achieve this by using the Arduino Software (IDE), which is based on Processing, and the Wiring based Arduino Programming Language.

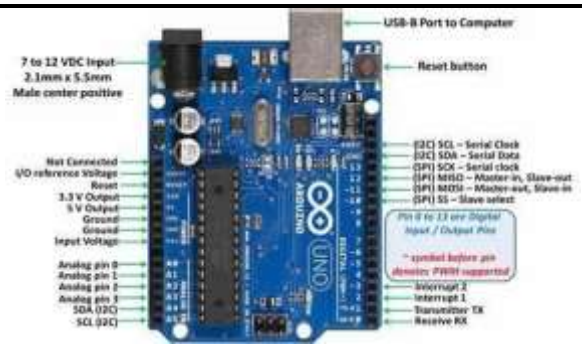

Figure 2: Labelled Arduino UNO

The one in Italian is called as Arduino UNO. It is from the ATMEL Family. Here we used ATMEGA328P microcontroller.

CNC Shield

Figure 3: CNC Shield

A motor driver is known as L293d IC. Like other ICs, it operates at low voltage. The other ICs might perform the same tasks as L293d, but they are unable to supply the motor with the required voltage. The Motor receives a constant, bidirectional direct current from L293d. Without affecting the entire IC or any other component in the circuit, the polarity of the current can change at any time. L293d has two motors and an internal H-bridge fitted. 2 INPUT pins and 1 ENABLE pin are used to power each motor. It is intended to drive various high-current/high-voltage loads in addition to inductive loads such solenoids, relays, DC motors, and bipolar stepper motors.

Servo Motor

A servo motor is a rotational or translational motor to which power is supplied by a servo amplifier and serves to apply torque or force to a mechanical system, such as an actuator or brake. Servo motors allow for precise control in terms of angular position, acceleration, and velocity.

Working

A potentiometer that is connected to the motor shaft by gears may sense the mechanical position of the shaft. The potentiometer converts the shaft's current position

into an electrical signal, which is then compared to the command input signal. Electronic encoders or sensors are utilised in contemporary servo motors to detect the position of the shaft.

Electrical pulses are used as the input for the commands. The speed of the motor is proportional to the difference between the current position and the needed position because the actual input provided to the motor is the difference between the feedback signal (current position) and applied signal (required position). The motor's power requirements are inversely correlated with the distance it must cover.

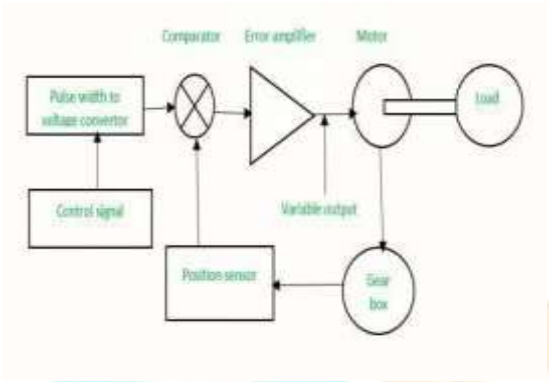

Figure 4: working of Servo Motor

DVD Drivers

Stepper Motor

A stepper motor is an electrical motor that transforms electrical input in the form of discrete angular movements, sometimes known as steps, from sequence of pulses. The motor completes one step for each input pulse during this conversion, which operates on a one to one basis.

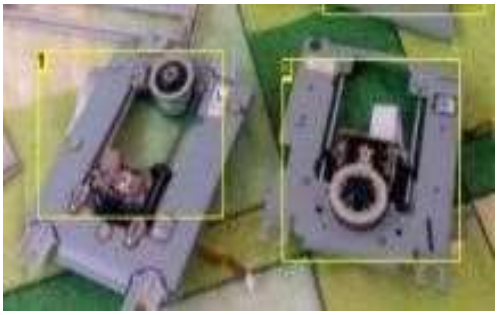

Figure 5: Movable trays with Stepper Motors

Working

Stepper motors operate on the electromagnetic concept. The electromagnetic stators are encircled by a soft iron or magnetic rotor shaft. Depending on the type of stepper, the rotor and stator have poles with teeth or without. In the case of a permanent magnet type stepper, the rotor moves to align itself with the stator when the stators are powered, or it moves to have the smallest possible gap with the stator (in case of a variable reluctance stepper). In this manner, the stators are sequentially powered to turn the stepper motor. See intriguing photographs at stepper motor Insight to learn more about how stepper motors operate.

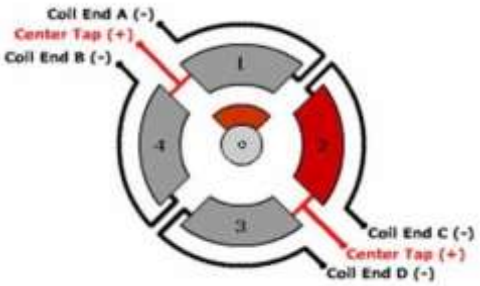

Figure 6: Stepper Motor Working

This project is not only about the hardware. It also consists of software in which the code and the Inkscape software along with processing is installed on our personnel computer.

Inkscape Software

It is possible to generate or edit vector images such as illustrations, graphs, line art, charts, logos, and intricate paintings using the free and open-source programme Inkscape.

Consistency and usability of the interface are among the top concerns of the Inkscape project. This includes efforts to adhere to the human interface principles, accessibility for all keyboards, and practical on-canvas editing. With the release of Inkscape, substantial usability improvements have been made project got going.

There are now fewer floating dialogue windows, and you can access their features in the editing window's docked toolbars or by using keyboard shortcuts. The window's tool bar controls always show the controls appropriate for the currently selected tool. The status bar, indications for all buttons, controls, commands, Keys, and on-canvas handles are all provided by Inkscape. The message hints in the status bar are dynamic. Up to four hints can be played for a specific object while it is being edited with just one tool.

Figure 7: Inkscape software and Selecting Axis

G Code

G code is a code with numerous variations. the most popular numerical control (CNC) programming language is known by this common term. It is mostly used to manage automated machine tools in computer aided manufacturing. G-code is a language used to instruct computerised machine tools to produce a certain item. G-code instructions given to a machine controller (industrial computer) specify the "how" by instructing the motors where to go, how quickly to move, and which path to take. The most typical scenario is when a cutting tool within a machine tool is moved in accordance with these instructions through a tool path and removes material until only the finished work piece is left. The same idea applies to non-cutting tools as well, such measurement equipment, photo plotting, additive processes including 3D printing, and foaming burnishing tools.

Processing

A GUI (Graphical User Interface) software called GCTRL works with GRBL. The programme
"Processing" is designed to run the GCTRL code. GCTRL offers jogging and sending G code control features.

Figure 8: Compilation of Arduino code and then Processing

RESULT

Command was initialised successfully. It was simple to convert the Inkscape image to g-code. Initially, the Arduino's GCTRL code and port selection were chosen. The MCU receives the G transformed code at first. As soon as the process starts, the motor successfully turns ON. The suspended paper was easily navigated by the pen cartridge. The image that was provided has been drawn in accordance with the instructions.

Figure 9: Final Output

Conclusion

This project has curated a straightforward, reasonably priced CNC plotter machine. It can write, cut, and engrave precisely and accurately in accordance with the needs. Due of its compactness, the device is compact and simple to use. It is simple to put together and move about. Although the project's plotting area is tiny, this does not restrict its applicability. The region may potentially be widened.

References

[1] Espalin, D, Muse, D. W., MacDonald, E., & Wicker, R. B. (2014). 3D Printing multi functionality: structures with electronics. The International Journal of Advanced Manufacturing Technology, 72(5-8), 963-978.

[2] Hashim, N. S. (2012). Design of mini machine (Doctoral dissertation, UMP).

[3] Jaya Chandraiah, B., Krishna, O. V., Khan, P. A.,

& Reddy, R. A. (2014). Fabrication of Low Cost Router. International Journal of Engineering Science Invention, 3(6), 01-10. [4] Torjus spilling "self-improving cnc milling machine" university of oslo (2014).