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CNC ENGRAVING MACHINE

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Abstract - *A CNC (Computer Numeric Control) engraving machine is a tool that utilizes computer- generated instructions to precisely engrave various materials such as, wood, and tire molds. The machines can be designed and fabricated to perform tasks like laser engraving, as well as routing with a cutting tool, like a router bit. These machines are often customized and can be based on open- source electronics, allowing for cost- effective and flexible solutions. The designs and fabrication processes of these machines are documented in research papers and publications, showcasing their versatility and potential applications.*

***Key Words*: Non Traditional Machining, Open Source CNC, CNC Engraving.**

1. INTRODUCTION

Engraving is a cutting technique or process of carving a design into a hard surface, to decorate or label on the objects made of different materials, typically using a set of hand engraving tools in the past, but CNC engraving is also available now. CNC engraving uses computer-controlled machines, which often applies the milling paths generated by CAD-CAM software based on the design drawing. Compared to manual engraving machines, CNC engraving machines, which reduces errors and improves speed, have the capability to do various sophisticated precision engraving, whether for practical or artistic purposes.

Research Objectives :

Engraving machines varies, but common goals include the precise engraving of materials such as wood, plastic, and tire molds. These machines are designed to create detailed images, patterns, or text, making them suitable for creating souvenirs, gifts, or industrial products. Research has focused on the design and fabrication of CNC engraving machines based on open-source electronics, with an emphasis on cost- effective solutions and specific applications such as wood engraving and milling. The importance of these machines lies in their ability to provide efficient and precise engraving solutions for a variety of materials, reducing errors and improving speed compared to manual engraving methods. CNC engraving machines are versatile tools that can be used for practical or artistic purposes, and they utilize different techniques such as laser engraving, CNC milling engraving, and CNC rotary engraving to achieve high- precision results.

2. Literature Review

Glass et al (1951) , the invention relates to reproducing devices or copying devices and particularly to pantographs other like. An object of the present invention is to provide pantograph for use with a heavy-duty metal-working or wood-working machine such as a milling machine. [1]

Wallace, (1821) invented the eidograph to improve upon the practical utility of the pantograph. The eidograph relocates the fixed point to the centre of the parallelogram and uses a narrow parallelogram to provide improved mechanical advantages [2]

P. Jamaleswara Kumar et.al. (2018) Day by day technologies are improving more and more. Humans are making machines more portable and digital daily. Here also author develops a portable laser engraving and cutting machine. The laser diode can cut different surfaces in different shapes. The more easy and convenient way to control this is by using Arduino CNC . The machine small and powerful for small scale industries. This machine is very easy to work, cost effective and very portable we can transport to one to another place without difficulty. [3]

Barra Jabbar et.al (2018) The world has become a high innovation with a ton of things decreasing and slenderer. The quickly developing advancement of innovation and assembling, Industrial prerequisite, for example, great and high accuracy quality has helped in building up the CNC machine plotter those can be accomplished through machines that can be constrained by PCs like Computer Numerical Control (CNC) machine. To execute CNC plotter machine, a few ideas should be seen, for example, getting

basics, Machine Mechanical plan, CNC machine equipment programming creating, test every last one of three hub stepper engines and interfacing CNC Machine with the product apparatuses and test it, Three tomahawks of CNC plotter machine can do development beginning with three essential tomahawks which are X, Y and Z hub. The Z pivot is being resembled with the X-hub (Michael W. Mattson, 2010). Figure 1 shows the means to carry out this paper should be perceived principal of the plotter machine, Machine plan by strong work programming, execution Machine equipment and wiring association. [4]

Mr. D. O. Shirsath et.al. (2017) Main objective of the author is to reduce the cost and man power for the machines which is used in industries and colleges. So, what he did is he fabricated the CNC engraver for making 2d images using laser module. It will used to engrave on wood plastic and leather. He uses CNC which means computer numerical control. By the help of CNC, we can control machine tools. Like grinding till we can control any tools using the CNC. For controlling and giving specific commands like feed rate, speed we have to use specific software, that will generate g code. G code is nothing but CNC machining language. In addition to CNC, he also using microcontroller and stepper motor for making the engraving machine. Arduino is the microcontroller . It's a 2 axis machine for x and y axis stepper motor is used for linear motion. For proper movement we have to synchronize the two stepper motors. For making the machine more compact and light weight he uses wood analuminum as profiles. A3967 is the stepper driver he used in his project for controlling stepper motor. What actually stepper motor do is it simply drive and controls the stepper motor. It can do by supplying voltage. He uses laser diode for etching process. More days Arduino becomes common and cheap microcontroller for making projects. It is free and easy to use. First, we have to feed the g code programs in to the Arduino. Then it will control all the electrical things which is connected to that. We can achieve our desired movements by the g code.[5]

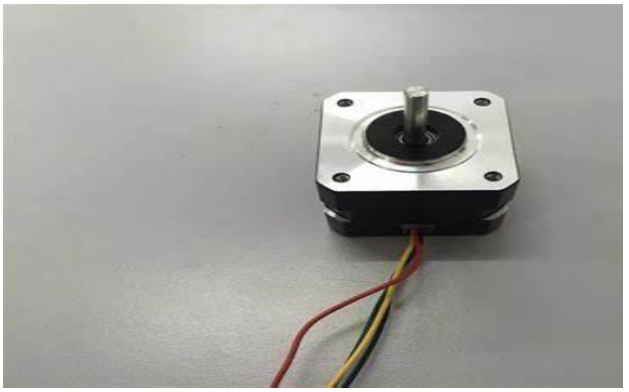
Fig -1: Simple Structural diagram CNC Engraving Machine.

- **Design of the Engraving Machine.**

The design of an engraving machine involves defining the problem, measuring the needs, exploring the design space, optimizing design choices, and developing the machine

COMPONENT	QUANTITY
Stepper motor	4pcs
Aurdino uno	1pcs
Cnc shild	1pcs.
Stepper motor driver	4pcs
Stepper motor driver	4pcs

{2.0} Nema 17 Stepper Motor:



Stepper motor specifications for a NEMA 17-sized motor include:

Rated voltage: 12V DC

Current: 1.2A at 4V

Step angle: 1.8°

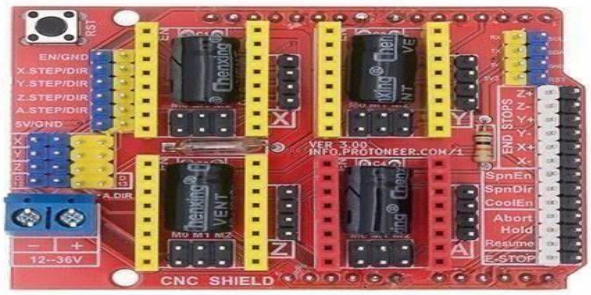
Operating temperature: -10 to 40°C

These specifications are for a typical NEMA 17 stepper motor, which is commonly used in applications such as 3D printers, CNC machines, and laser cutters.

Arduino:

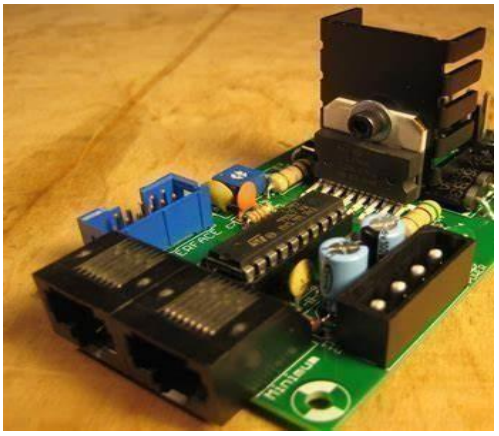
The Arduino Uno is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. It can be powered via a USB connection or with an external power supply, and it contains everything needed to support the microcontroller.

CNC Sheild:



The CNC Shield V3.0 allows users to build an engraving machine, 3D printer, mini CNC, and other similar devices using an Arduino. It is designed as a shield and can plug on top of an Arduino requiring no external connections and wiring. The CNC Shield is compatible with GRBL 0.9 and has four slots for plugging in stepper motor drive modules, which can drive one stepper motor each.

Stepper Motor Driver:



The A4988 driver features adjustable current control, over-temperature thermal shutdown, under-voltage lockout, and crossover-current protection. It is designed to control one bipolar stepper motor at up to 2A output current per coil and is compatible with both unipolar and bipolar stepper motors. The driver's compact size and various microstep resolutions make it suitable for a wide range of applications, including 3D printers, CNC machines, and other automated system.

3.WORKING PRINCIPLE:

The Computer-numerical control (CNC) machining is used primarily by the manufacturers to manufacture machined parts, products, items, etc. CNC machine utilizes Computer Numerical Control to control machine tools like lathes, routers, grinders or mills. The Computer Numerical Control is different from the typical PC type software used to control a machine. It is specially customized and programmed with G Code, a specific CNC machine code language that allows precise control of the features like speed, location, co-ordination and federate. Specialized software drives the computerized machining process. The G-code loaded software sits within a computer that looks like a sophisticated desktop. A programmer at the computer console can control the machine work that would be equivalent to multiple operators on lathes, grinders, routers, mills, and shapers.

The automated machining method can achieve actions that human operators and conventional machines typically don't do efficiently. Basic machines have cutting implementation along X and Y-axes that can be worked independently and simultaneously. Advanced machines have more than five, axes that perform similarly, and have the capacity to turn and flip the part. CNC machines can automate the jobs that require several cuts. A router or spindle turns to implement the cutting operation, resembling a drill bit. A true drill bit cuts only at the tip, while nearly all of a router bit cuts the material. The programming in CNC machines incorporates all the coordinates and high-speed movements required to manufacture the object, and it enables detailed customization.

The scope of this project was to design and fabrication of milling and drilling machine which focus on the main operation i.e. milling and drilling. The project began with the collection of information and data on user lifestyle and current process by which they perform their job. The Concepts was developed with reference of different types of milling machine and their different operating processes. The project was developed considering the safety factor user operating environment and maintenance. Considering the users need and buying capacity, this prototype was fabricated. The machine consists of Lead Screw, Motor

Driver, Stepper Motor, Arduino, Spindle Motor and Aluminum Extrusion Frame. In this project, the position of the drill hole and milling operation is taken by the developed software. Then it calculates the previous and current co-ordinate and sends the coordinate information Micro-controller unit over USB cable. Stepper motors move on the basis of co-ordinate information to accomplish the drilling and milling operation.

4.CONCLUSIONS

The CNC engraving Machine have revolutionized the engraving industry by offering precision, versatile ,automation, customization, and cost-effectiveness in producing high quality engraved products. As technology continues to advance, CNC engraving machines will remain essential tool for business seeking to deliver exceptional craftsmanship, creativity, and innovation in their product and services.

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