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## Laser Engraver

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### ABSTRACT

This document outlines the creation of a versatile laser engraving device that offers precise and customizable engraving features for a range of applications. The device comprises key components including a laser slider module, power supply unit, Arduino Uno microcontroller, A4988 stepper motor driver, IRFZ44N MOSFET, LM7805 voltage regulator, capacitors, resistors, terminal blocks, and a cooling fan. The significance of this project is its capacity to produce detailed and accurate engravings, making it ideal for applications in arts and crafts, personalized gifts, and design.

keywords: - Laser Engraver, Accurate, Customizable capabilities, Components, Various applications.

### Introduction

The report discusses the laser engraver project, which aims to create and enhance the engraving process. The Arduino Uno provides programmability, enabling users to customize engraving patterns, speed, power levels, and other settings. This flexibility makes it easy for users to achieve their desired engraving results. The A4988 drivers are crucial in the system as they control the stepper motors that operate the Laser-Slider modules. These drivers ensure precise control over the sliders' movement, leading to smooth and accurate positioning. By combining the Arduino Uno and A4988 drivers, the system allows for simple customization, responsiveness, and compatibility with various user interfaces.

IRFZ44N MOSFET is utilized. This MOSFET functions as a switch, managing the power supply to the laser module and enabling modulation and intensity adjustments while engraving. Safety precautions like wearing protective goggles and ensuring adequate ventilation are crucial when using the laser engraver to reduce the chances of accidental exposure to the laser beam.

The LM7805 voltage regulator, in conjunction with capacitors and resistors, maintains consistent voltage levels and filters the power supply to reduce electrical noise and interference. These components play a vital role in enhancing the overall reliability and performance of the system. Block connectors make it easy to wire and connect multiple parts, making installation and maintenance easier. This modular approach increases the scalability and adaptability of the system. The fan helps dissipate heat, increase visibility of operating temperature and extend life.

In conclusion, the laser engraving machine project presented in this report aims to create a powerful and efficient engraving system. Integrating laser shifter modules, power supplies, Arduino uno microcontrollers, A4988 drivers, IRFZ44N MOSFETs, LM7805 voltage regulators, capacitors, resistors, block connectors and cooling fans, the system provides clear control and customizability options and security features.

### Objectives of the Study

Design and build a versatile and effective laser engraving system that improves the accuracy of some parts. Provides better hard material quality and the ability to engrave on different surfaces. Low-cost installation that does not affect quality and performance. Developing low-cost solutions without compromising on quality and functionality. The complete design is enclosed in the machine to prevent dust and smoke during engraving.

### Literature Survey

Dr. S Ganesh Kumar<sup>1</sup>, Nishanth Kumar T<sup>2</sup>, Ragul J<sup>3</sup> The feature of this machine is that the user can adjust the tool when he wants to work on various engraving products (materials - acrylic, MDF board, foam board, etc.) and share 2D drawings of custom items on A5 paper. The laser engraving machine responds to the G code generated by the software. The operation of the machine frame and the object will follow the Cartesian mode.

Ginna Vaishnavi1, Dr. D.V. Srikanth All work is done in the design and construction of the laser engraving machine. The final model of the machine has been completed and adjusted to work with the laser module in all requirements. Criteria to print an image. With the up gradation of laser printer, we were able to gain accuracy to a Certain extent which can further be modified for acquiring a better Surface finish. Further experimentation could possibly help Engraving of hard materials.

Parth Rawal, Kartik Prajapati, Radhen Jasani Thanks to the combination of hardware and software, the machine will provide better accuracy and reduce workload. This machine can engrave different areas by changing the engraving pen. This machine can be used by teachers, students and offices that need to fill in some information manually. The production of small machines can be easily carried out in the enterprise We can draw or write on the smartphone. We can use this machine to engrave company name and logo on different surfaces.

Sridutt H R1, Sachin M2, Pramod M3. The use of the laser plays an important role and depends on the type of material used for engraving. The depth and width of the cut depend on the intensity of the laser and the height of the laser beam. This is a faster and more accurate method than the traditional method.

Zain Hossain Khan, Tashinur Rahman, Salman Arabi the advancement of technology has increased the use of CNC systems in industries, but at high costs. The aim is to create a low-cost CNC machine that reduces complexity and expense. The machine enables 3-axis simultaneous operation and engraving. An Arduino-based embedded system is used to connect a standard PC with a microcontroller-based CNC structure.

Mr. Sachin Patel, Asst. Prof. Sandip. Patel. many researchers have used different types of lasers to examine different types of materials. Researchers have used various design of experiments (DOE) techniques such as general design, Taguchi method, Box- Behnken design and response surface, as well as different optimization methods such as GLA methods, gray correlation methods, nova analysis. Studies have been conducted on the effect of the process on different materials such as AISI 304 Steel, C45 Steel, Wood, Bamboo, Al 7075 and stainless steel, and its different properties such as MRR, surface roughness, depth and notch width.

K. Prashant, Mohamed Iqbal Khatib, Abdul Shahruckh as globalization and industry expand, machines have shifted from manual to automatic control. Our project is a great example of a portable, user-friendly automatic unit. Our laser engraving machine is controlled by computer numerical control (CNC) and G-codes, which provide instructions to the machine. These codes enable the machine to operate efficiently without heavy human involvement. It works fast and accurately. By making it portable and user-friendly, we've learned more about CNC machines and how easily they can be used and transported by anyone.

A.P. Singh, Aman Tripathi, Abhinav Nagar, Himanshu Choudhary main objective of the papers communicates the option of making a prototype of laser cut engraver CNC at low- cost that would capable to trace engrave on a 210 x 290 millimeters sample size. The prototype machine with low power consumption and operate in high accuracy by use of accurate stepper motors.it was observed that we can made low-cost CNC laser engraver for different material with different dimension. "Design and Fabrication of CNC Laser Engraver using Microcontroller".

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## Components & Specification

### *Laser*

- Optical Power: 200-250mW
- Wavelength: 650nm (red laser),
- Voltage: DC 3-5V, Current: !300mA
- Beam Shape: dot, Size: 12X45mm



Fig.1 Laser

### *Stepper Motor Slider*

- Rod Outside Diameter: 8mm;

- Length: 500 mm; Pitch: 1.25mm;
- Material: SS 304 (Stainless Steel). 5mm to 8mm Flexible Coupling.
- Torque: 4.2 Kg-cm; Step Angle: 1.8 deg / step



Fig.2 Stepper Motor Slider

### Arduino Uno

- Voltage of operation: 5V.
- Recommended input voltage: 7–12V.
- Limits on Input Voltage: 6–20V.
- 20 mA of DC current per I/O pin
- There are 14 digital I/O pins, Pins for Analog Input: Six.



Fig.3 Arduino Uno

### Power Supply

- 12 volts DC output voltage
- Current output: 5 A
- Voltage input range: 100V to 240V AC.



Fig.4 Power Supply

### Cooling Fan

- Operating Voltage: 12V DC
- Very low Current consumption
- Noiseless Performance

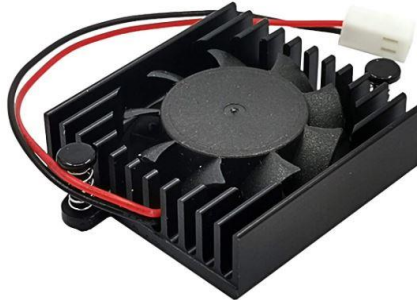


Fig.5 Cooling Fan

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### Implementation

The Arduino Uno microcontroller serves as the intelligence base by taking the power of the laser slider module. It cooperates seamlessly with the A4988 driver for precise control of the stepper motor, which is the most important thing for accurate laser positioning and therefore optimum engraving results. Allows adjustment of laser power. These features improve the engraving process by providing the flexibility to adjust the density, enabling a variety of engraving effects based on specific designs. power source.

This is important to reduce electrical noise and maintain accuracy, especially when working with designs that require high detail. The process of achieving both goals. This not only ensures the operation of the system, but also improves the overall efficiency of the laser engraving machine by making maintenance and troubleshooting easier.

These devices work to control temperature, contributing to the longevity and reliability of laser modules and other important components. The project's forward-thinking approach to design is reflected in the project's continued success over its long artistic run. Each element has been carefully selected and coordinated to play a key role in providing precise, consistent and reliable laser engraving functionality. Commitment to excellence and durability is the essence of this work and reflects the commitment to achieving the best results in laser engraving technology.

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### Result & Conclusion

From the overall work carried out in the laser engraving machine, the final structure of the machine is physically set to work with the laser module. Patterns printed using laser printers provide some accuracy and can be further adjusted to achieve the correct surface finish. The use of the laser plays an important role and depends on the type of material used for engraving. This machine will be easy and comfortable to use. It has many uses. The machine is cheap and flexible and can be used for personal purposes.

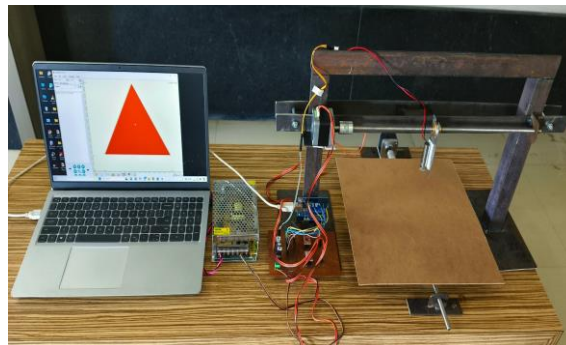


Fig.5 Laser Engraver Result

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