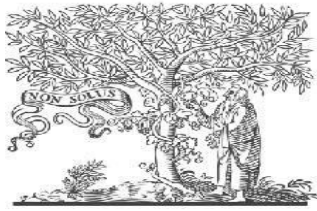


COPY RIGHT



ELSEVIER
SSRN

2023IJIEMR. Personal use of this material is permitted. Permission from IJIEMR must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating new collective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works. No Reprint should be done to this paper, all copy right is authenticated to Paper Authors IJIEMR Transactions, online available on 19th May 2023.

Link : <https://ijiemr.org/downloads/Volume-12/Issue-05>

10.48047/IJIEMR/V12/ISSUE05/37

Title **THE CNC LACER ENGRAVER**

Volume12, Issue 05, Pages: 376-386

Paper Authors

Mrs Yasmeen Sultana, Mohd Junaid Ahmed, . Shaik Mohd Abdul Razzak Umair Ahmed, S M Jalaluddin Farooqui



USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per **UGC Guidelines** We Are Providing A Electronic Bar Code

THE CNC LACER ENGRAVER

1. **Mrs Yasmeen Sultana, Assistant Professor**, Department Of ECE, Deccan College Of Engineering And Technology, Telangana, India, yasmeendeccan@gmail.com
2. **Mohd Junaid Ahmed, Student**, Department Of ECE, Deccan College Of Engineering And Technology, Telangana, India, mohammedjunaid74047@gmail.com
3. **Shaik Mohd Abdul Razzak Umair Ahmed, Student**, Department Of ECE, Deccan College Of Engineering And Technology, Telangana, India, razzakumair7@gmail.com
4. **S M Jalaluddin Farooqui, Student**, Department Of ECE, Deccan College Of Engineering And Technology, Telangana, India, sj952611@gmail.com

Abstract: In laser engraving the laser beam burns the top layer of the surface to be engraved. The burnt area is left uncolored which makes it appear different from the surrounding surface. While in laser cutting laser beam has to penetrate through the surface. This can be achieved by prolonging the beam on a particular area for a long period of time, duration being decided on the strength of material to be cut. We are still collecting data from different resources to know this topic more in depth. In our project we have decided to develop working model of laser cutting and engraving machine. This machine is very useful in our department since it's a kind of rapid prototyping machine. It can cut out paper patterns and thermoplastic sheets to produce desired shape and patterns. Till now we have collected information on laser cutting, laser and what engraving is. Laser cutting is different from laser engraving, in case of engraving very low intensity laser torch is used as compared to laser cutting. We got a brief introduction on laser, how it works, what are its properties, how to generate it and how to control its intensity. It might not cut through chunks of wood but surely burn the top layer. Simulation analyses are performed in

BENBOX software 'SOLID WORKS' in order to simulate each part of the machine. It was helpful for remodeling the moving bed or the job holder, if any errors found during the simulation. Additionally, experiments are performed for the develop laser cutting engraving machine.

Index Terms: CNC Shield, Benbox, Arduino UNO, Slider, SMPS.

1. INTRODUCTION

The CNC stands for Computer Numerical Control used in the manufacturing sector that involves the use of computers to control machine tools. Tools that can be controlled in this manner include lathes, mills, routers and grinders. On the surface, it may look like a normal PC controls the machines, but the computer's unique software and control console are what really sets the system apart for use in CNC machining. Under CNC Machining, machine tools function through numerical control. A computer program is customized for an object and the machines are programmed with CNC machining language (called G-code) that essentially controls all features

like feed rate, coordination, location and speeds. With CNC machining, the computer can control exact positioning and velocity. CNC machining is used in manufacturing both metal and plastic parts. Inspiring from this CNC technology and revolutionary change in the world of digital electronics & Microcontroller, we are presenting here an idea of “Arduino Based CNC Machine Controller”. The idea behind this project is to make a small Two Axis CNC router which can engrave 2D and Gray scaled images or pictures with help of high watt burning laser module on surface which can be a paper, wood, leather, plastic, foam etc. It uses two stepper motors as linear actuators on each axis X, Y. While engraving, the proper synchronization of all this axis i.e. stepper motors, is most challenging task. As proposed idea, the machine will be built within a miniature structure. Entire structure will be built from wooden or aluminum sections. To keep a lowest weight as possible, aluminum will be preferred. The X, Y actuators will be made with high torque industrial stepper motors & Timing Belt – Pulley combinations. The stepper motors will be driven by A3967 based micro stepping stepper motor drivers. It drives & controls the operations of stepper motor by using STEP-DIR algorithm. It provides high current play on each coil of stepper motor. It controls the stepper by giving supply voltage directly to the coils of the stepper motors.

The CNC laser engraver works by using a high-powered laser beam that is directed through a series of mirrors and focused onto the material to be engraved or cut. The laser beam is controlled by a computer program that follows a specific design, and the beam moves along the material's surface to create the desired pattern or shape. The CNC laser engraver

is widely used in various industries, including woodworking, signage, jewelry making, and industrial manufacturing, among others. It has revolutionized the engraving and cutting process by providing greater accuracy, speed, and flexibility in design. Additionally, the use of a CNC laser engraver eliminates the need for manual labor, resulting in increased productivity and cost savings for businesses.

The scope of the CNC laser engraver project includes the design, development, and construction of a computer-controlled machine that is capable of engraving and cutting a wide range of materials with high precision and accuracy. The project will involve selecting the appropriate components, including the laser, motors, controllers, and software, to ensure that the CNC laser engraver is reliable and efficient. The project's scope also includes designing and constructing a robust and durable frame capable of withstanding the rigors of frequent use in various industrial settings. The frame should be designed with safety features to ensure user safety and prevent accidents. In addition to the hardware, the scope of the project also includes developing and programming the software required to control the CNC laser engraver. The software will allow for easy customization and modification of designs, enabling users to create unique and intricate patterns quickly. The project's scope includes testing the CNC laser engraver's functionality and performance to ensure that it meets the required specifications. The testing phase will involve cutting and engraving various materials to assess the machine's accuracy, speed, and efficiency. Finally, the scope of the CNC laser engraver project includes providing user manuals and training to ensure that users can safely and effectively

operate the machine. The project's ultimate objective is to provide businesses with a cost-effective solution that will increase productivity and reduce operational costs.

2. LITERATURE REVIEW

3-Axis CNC Router Modifiable to 3D Printer

Numerical control is such a useful thing that can control a machine with numeric values and codes. That is what we call CNC[1,5] machine, used in machining or any other automation. The commercial CNCs are bulky and so much expensive and not possible to afford by normal people in home. So the machine with computer ability and in less size mini CNCs came in. CNCs are much complex in its function. It works with the simultaneous interpretation of software and hardware. The three axis motion is controlled by Arduino Uno board with Atmega[9] 328p microcontroller. The Arduino works here as an open source burner which burns the microcontroller with given hex codes. The CNC shield along with stepper motor drivers[6,7] basically receives the signals from the Arduino board and delivers the power to the stepper motors. Here GRBL[3] software is used to convert G-codes[3] of a specific design to the Arduino compatible code. In this paper we tried to build a very affordable CNC with more up gradation. Here we fabricated a 3 axis CNC router with completely automatic functions and tried to make it conversable to 3D printer[4]

Automated System Design For Pick & Place of M/C Components of CNC-Lathe – A Review Paper

Commercial and industrial pick and place systems are now in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty, dangerous or dull to be suitable for humans. Pick and Place Systems are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods. Today, In Machining Industry Pick and Place from CNC Machining is very boring and repetitive work on the other hand in this competitive world, the cost of six axis manipulator (Robot) is very costly from application point of view. So each customer wants to develop the system which is low in initial cost as well as running cost.

Current Progress of 3D Concrete Printing Technologies

The construction industry is expected to go through large transformations since construction automation is anticipated to drastically alter standard processing technologies and could lead to possible disrupting technologies such as 3D concrete printing (3DCP). While 3D printing techniques have been successfully applied in a wide range of industries such as aerospace and automotive, its application in concrete construction industry is still in its infancy. 3DCP can allow freeform construction without the use of expensive formwork, which in return offers excellent advantages compared to conventional approach of casting concrete into a formwork. In the last few years, different 3DCP technologies have been developed. This paper presents the current progress of 3DCP technologies. An innovative methodology recently developed by the authors of this study for

formulating geopolymer-based material for the requirements and demands of commercially available powder-based 3D printers is also briefly presented.

Laser Cutting Machines for 3-D Thin Sheet Parts

Laser cutting machines are used for precise contour cutting thin sheet. In industrial application nowadays various types and construction of laser machines can be met. For contour cutting 3-D thin sheet parts laser cutting machines with rotation movements and laser robots are used. Laser generates the light beam that presents a tool in working process. Application of laser cutting machines made possible good quality of products, flexibility of production and enlargement of economy.

A novel automatic low cost cutting machine-cum-3D printer using an image processing based control

Over the past 5 years, there has been a tremendous rise in designing various prototypes for a 3D printer. While most of them concentrate on accuracy and speed, the cost has always been a concerning factor. In this paper, we present a novel cost effective setup which could be used for both the X and Y axis motion, which is required for either a 3D printer or a cutting machine which is widely used in any industry. The paper also concentrates on creating a CAD tool independent interface with inputs to the setup being given purely based on images drawn. This simplifies the process with the user not needing to have any computer knowledge at all. All image processing algorithms were designed and developed using Simulink - a part of MATLAB 2011b and controls to the setup were given using an Arduino Uno

(ATmega328) Rev. 3 board, in turn creating a perfect embedded system setup.

Python based 3-Axis CNC plotter

This paper discusses on an open source python based three-axis CNC system. Python being one of the easiest languages to understand exempts the user from requiring extreme programming skills to amend the code for personal use. This paper features a novel way of directly importing the CAD file into the system without the use of any G-code parser. This system is economical as it utilizes Arduino UNO board as a signal generator without compromising on the performance of the system.

3. METHODOLOGY

The existing CNC laser engraver is a computer-controlled machine that uses a laser beam to engrave, cut, or etch a variety of materials. It has three main components, including the mechanical, electrical, and software systems. It is a highly precise machine that is widely used in various industries and requires expertise in multiple engineering disciplines to build and operate. The CNC laser engraver is a valuable investment for businesses that require high-quality engraving and cutting services.

The proposed system of CNC laser engraver aims to improve upon the existing system by adding new features and capabilities. The proposed system will include additional safety features, such as emergency stop buttons and safety interlocks. It will also have a user-friendly interface that will allow users to upload designs, adjust laser intensity, and control the machine's movement. The proposed system will have a camera to capture images of the surface being engraved, allowing for the creation of custom patterns. It will also include a cooling system to

prevent the laser from overheating during extended use. The proposed system will be tested for durability and reliability to ensure that it can withstand extended use without any issues. Overall, the proposed system of CNC laser engraver aims to provide a more efficient and user-friendly experience while maintaining the precision and accuracy of the existing system.

Components Used

- CNC Shield
- Benbox
- Arduino UNO
- Slider
- SMPS

This chapter illustrates the software use for the CNC Laser Engraver, the idea and the component used in the hardware system design of the CNC Laser Engraver. The process and system flow of the Engraving are mentioned in this chapter to give a clear illustration on the system design.

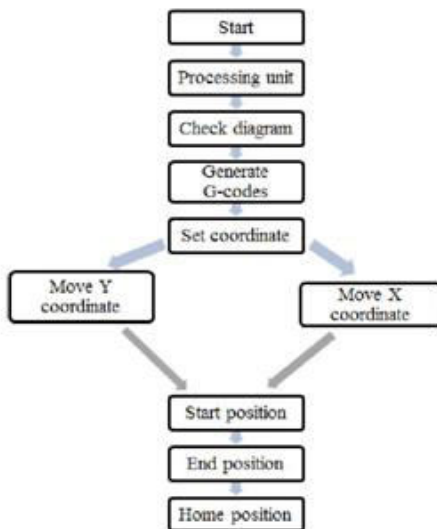


Fig 1 Flow diagram For Proposed System

4. IMPLEMENTATION

The item for the proposed system is executed utilizing the Arduino IDE.

Integrated Development Environment (IDE) for Arduino: A substance chief for composing code, a message region, a message terminal, a toolbar with buttons for normal undertakings, and a progression of menus are totally expected for the Arduino IDE. It talks with the Arduino equipment and sends dares to it.

File

New creates a new supervisor instance with all of the essential features of the drawing present.

allows you to browse the envelopes and papers on your PC to create a sketch record.

At the point when you open Later, a rundown of the latest drawings that might be gotten to is shown.

Within the envelope structure of Sketchbook, the corresponding representation is displayed in a different proofreading case whenever any name is mentioned.

Models All models provided by the Arduino Programming (IDE) or library are displayed when this menu option is selected. The models are arranged in a tree, making it simple to search by library or subject.

closes the Arduino Programming instance clicked.

Save The current name is used to save the artwork. A name will be proposed for the record in a "Save as..."

exchange on the off chance that it has not as of now been named.

You can save the current drawing under a different name by selecting "Save as..."

It shows the printing-explicit Page Setting window.

In accordance with the Page Arrangement limits, Print sends the ongoing drawing to the printer.

By clicking Inclinations, you can change many IDE settings, like the language of the IDE interface.

All IDE windows are closed by Stop. The next time you start the IDE, the open drawings that were open when Stopped was selected will be restored immediately.

Edit

- Record at least one stage of modification as a fix or retry; You can use retry again when you come back.
- Cut The chose text is replicated to the clipboard and eliminated from the editor.
- After reproducing the text from the proofreader, duplicate copies the selected text and copies it to the clipboard.
- Copy the code for your sketch to the clipboard in a format that is suitable for presenting on the discussion with punctuation shading. Duplicate for Collection

- Duplicate as HTML recovers the code from your sketch and copies it to the clipboard as HTML, ready for use on websites.
- Glue the contents of the clipboard into the supervisor by copying them there from the clipboard.
- The entire selection made by the manager is included in Select All.
- Remark/Uncomment Inserts the /remark tag at the beginning of each line or removes it altogether.
- Indent adds or subtracts a space at the beginning of each selected line, moving the text one space to the side or removing a space.
- When you click "Find," the "Find and Supplement" window opens. Here, you can use a few models to figure out the text you need to look for in the ongoing plan.
- Depending on where the cursor is, Find Next will highlight the following event, if any, of the string that was entered in the Find window as the pursuit object.
- Based on where the cursor is, Find Earlier highlights the preceding event of the string in the Track down window.

Sketch

Verify or arrange your drawing after checking for errors while it was being made. In the control center

section, it will show the factors and the amount of memory used by your code.

Transfer stacks the parallel record onto the designated board via the predefined Port after aggregation.

Using a software engineer to transfer This will replace the board's bootloader; Go to Devices > Consume Bootloader to reactivate the option to transfer to the USB sequential port. Nevertheless, it enables you to make use of the entire Blaze RAM for your artwork. Keep in mind that following this advice will not result in the wires lighting up, assuming it isn't too much work. Navigate to Apparatuses > Consume Bootloader to accomplish this.

Send Out Completed Double produces a.hex file that can be filed or sent to the board using a variety of tools.

In the ongoing representation organizer, open the Presentation the Sketch Envelope order.

Add a library to your drawing by using the #include instruction at the beginning of your code. For more details, see the libraries listed below. From this menu item, you can also import new libraries from.zip files and launch the Library Director.

A new document is added to the drawing using Embed Document... it will be duplicated from its current location). As is customary for assets like documentation, the record is saved in the sketch's data subfolder. The sketch programming excludes the objects in the information envelope because they have not been gathered.

Tools

Your code is precisely arranged by Auto Arrangement by indenting it so that the declarations contained within the wavy supports are also indented and the opening and closing wavy supports line up.

The current drawing is saved as a.zip file using Document Sketch. The chronicle and the artwork are kept in the same envelope.

Reload the page and resolve the encoding issue. The proofreader's single map encoding and the roast guides of other functioning frameworks are unaffected by this.

Screen for Successive beginnings the information exchange with any connected board on the at present chosen Port and opens the comparing screen window. On the off chance that the board upholds it, this for the most part resets it. Perform a reset to prevent the sequential port from opening.

Board Select your preferred board. The various sheets are depicted in the following image.

All of your PC's real and simulated sequential devices are stored in this menu. You should feel immediately energized as soon as you enter the high level gadgets menu.

Software developer: Programming a board or chip without using the USB-sequential connection that is already installed is done with a hardware developer. In any case, if you want to modify a brand-new microcontroller, you will require this.

Consume Bootloader You can embed a bootloader into the microcontroller of an Arduino board by utilizing the options in this menu. This is useful if you buy a different ATmega microcontroller, which sometimes doesn't have a bootloader, but it doesn't affect how the Arduino board works on its own. Make sure that the appropriate board has been selected from the Sheets selection before eating the bootloader on the goal board. The necessary wiring was also installed as a result of this direction.

5. RESULTS AND DISCUSSION

Before some product is complete, there must be some testing phase carry out that the functionality and also the quality of the product. In this section, some printed hardware components and limit switch homing system for the machine have been discussed. Several types of image have been drawn and discussed in this section. Two users been invited to test on the product quality.

The part of the hardware components like the stepper motor holder, linear bearing holder, Laser holder, X-axis plane have been design by using the Software software and printed by the Laser. In this section, the design hardware components and the components were discussed.

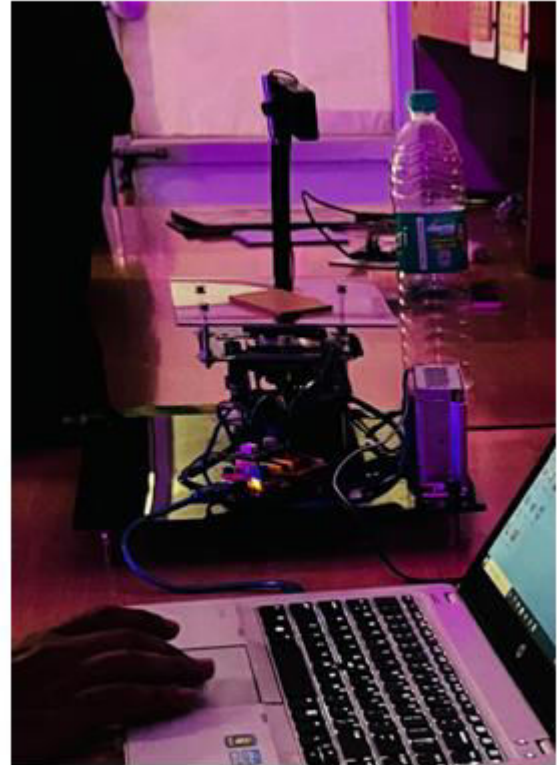


Fig 2 Output Screen



Fig 3 Output Screen



Fig 4 Engraved Image Screen



Fig 5 Original Import Image

6. CONCLUSION

In conclusion, the objectives of this project have been achieved. An Arduino based CNC machine which able to move along x-axis and y-axis was built. The cost for building the CNC Laser is lower compare to the industries which able apply on small businesses and family use as the cost is affordable by family and small businesses. The CNC Laser built was successfully communicated with the software to carry out given task. The gcode file image that created from the Inkscape software was successfully transferred to CNC Laser for drawing. The import images and the input images were successfully

convert to the gcode file and been drawn by the CNC Laser. The drawn images scale is exactly same with its original import images and input images. Two users have been invited to use the CNC Laser. Both users were satisfied with the results drawn by the CNC Laser machine. The Laser speed of the CNC Laser has been increase according to the user feedback. Extra feature like the homing system had successfully added on this project. Some of the hardware components have been designed and printed using CNC Laser to cut down the building cost of CNC Laser.

7. FUTURE SCOPE

Some recommendations on future enhancement of this project are listed below. The recommended enhancements can be implemented for project extension in future.

Three Dimension Laser

The concept use for the CNC laser Machine is same as the CNC Laser machine. Extra axis need to be added on the CNC Laser machine to perform CNC Laser Machine. With additional axis added, a CNC Laser can carry out different function task.

Software Development

As the functionalities of single CNC Laser increase, extra software will be required to install so that the CNC Laser can carry out the tasks. For example, to use the CNC Laser Machine, out the Engraving software is required. However, user may fail to use the correct software to carry given tasks and this will not be user friendly. Software that includes all functionality of the CNC machine will be simpler to handle and operate by user. A user friendly software

and hardware will make the product look more attractive to the user.

REFERENCES

1. Arduino.cc. (2017). Getting Started with Arduino and Genuino UNO. [online] Available at: <<https://www.arduino.cc/en/Guide/ArduinoUno>> [Accessed 1 January 2019]
2. Dey, D., Mondal, S. and Barik, A.K. (2016). 3-Axis CNC Router Modifiable to 3D Printer. International Journal of Innovative Research in Science, Engineering and Technology, [e-journal] 5(9), pp. 16983-16990. Available through: IJRSET website <http://ijrset.com/upload/2016/september/69_28_3_Axis.pdf> [Accessed 13 January 2019]
3. GitHub, Inc. (2019). MakerBot Unicorn G-Code for Inkscape. [online] Available at: <<https://github.com/martymcguire/inkscape-unicorn>> [Accessed 20 January 2019]
4. GitHub, Inc. (2019). Grbl with Pen Servo Feature (Arduino UNO – ATmega 328p version). [online] Available at: <https://github.com/bdring/Grbl_Pen_Servo> [Accessed 21 January 2019]
5. Modi, H.A. and Prof. Patel, D.M. (2015). Automated Design for Pick & Place of M/C Components of CNC-Lathe. International Journal for Innovative Research in Science & Technology, [e-journal] 2(2), pp. 36-39. Available through: IJRST website <<https://ijrst.org/Article.php?manuscript=IJIRSTV2I2021>> [Accessed 20 June 2018]
6. Nematollahi, B., Ming, X. and Sanjayan, J. (2017). Current Progress of 3D Concrete Printing Technologies. 34th International Symposium on Automation and Robotics in Construction, [online] Available at: <https://www.researchgate.net/publication/318472250_Current_Progress_of_3D_Concrete_Printing_Technologies> [Accessed 25 June 2018]
7. Radovanovic, M. (2002). Laser Cutting Machines For 3-D Thin Sheet Parts. 8th International Conference, Image Processing Based Control. IEEE Bombay Section Symposium (IBSS), [e-journal] Available through: Universiti Tunku Abdul Rahman Library IEEE website <<https://ieeexplore.ieee.org/document/7456641>> [Accessed 23 February 2019]
8. Shivakumar, T. and Selvajothi, K. (2016). Python based 3-Axis CNC plotter. IEEE International Conference on Power and Energy (PECon), [e-journal] pp. 823-827. Available through: Universiti Tunku Abdul Rahman Library IEEE website <<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7951672&isnumber=7951457>> [Accessed 12 January 2019]
9. Sutarman, EdiHermawan, H. and Sarmidi. (2017). Computer Numerical Control (CNC) Milling and Turning for Machining Process in Xintai Indonesia. Journal of Research in Mechanical Engineering, [e-journal] 3(5), pp. 01-07. Available through: Quest Journals Inc. <<http://www.questjournals.org/jrme/papers/vol3issue5/A350107.pdf>> [Accessed 21 January 2019]