

DESIGN AND FABRICATION OF LASER ENGRAVER

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Abstract - This project proposes the technique used to design and develop a Computer Numeric Controlled Laser Engraver and 2D Plotter (All in one machine). The specialty of this machine is that the user will change the tool easily whenever he/she wants to perform many operations such as engraving an object (Materials - Acrylic, MDF board, Foam sheets, etc.) and also produce a 2D drawings for a particular object in A5 size sheet. Both laser engraver and 2D Plotter responds to G Codes which can be generated by the software. Frame of the machine and the working of the components will be based on the Cartesian type. It is a commercially viable and cost-effective machine.

Keywords - Laser Diode, Engraving, Proterface software, Nebarnix software, Laser Module, FRP Material.

1. INTRODUCTION

LASER ENGRAVING, which is a subset of laser checking, is the act of utilizing lasers to etch an item. The effect of laser checking has been increasingly articulated for uncommonly planned "laser capable" materials and furthermore for a few paints. These incorporate laser- delicate polymers and novel metal composites.

The material to uncover a hole that uncovers a picture at Eye level. The laser makes high warmth during the Laser etching is where the laser pillar genuinely expels the outside of etching process, which basically makes the material disintegrate.

2. LITERATURE REVIEW OF LASER ENGRAVER

Dharmesh K. Patel (2014): Parametric Optimization of Laser etching process for various Material utilizing dark social strategy. Laser engraving process is non-regular machining process used for stamping/etching of practically every material which cannot be mark by traditional machining process. In laser engraving forms the outside of material is heat up and subsequently disintegrate the material. With the utilization of laser etching machine, the checking/etching is conceivable by using different input parameter as spot distance across, laser power, laser frequency, distinctive frequency and so on and get changes in output parameter like material evacuation rate, surface completion and space. To improvement of every one of these parameters with numerous examining dark social evaluation, it exhibitions trademark dependent on the dim social examination. By will be seen what parameter has more impact on reactions of information parameter to the yield parameter. It will reason that the laser engraved profundity got further for either higher laser power or a lower feed speed proportion.

SefikaKasman (2013): He has been explored effect of parameters on the procedure reaction, a label chi analysis symmetrical investigation for laser etching. Laser etching is the best method in the machining of hard materials has a perplexing geometry. The current examination explores the mach failure of hard metal delivered with powder metallurgy and advances another way to deal with their enduring to the laser etching of P/M metals. The principle goal of this investigation is to decide the effect of laser etching process on powder metallurgy cold work apparatus steel: Vadnais 10. For this reason, three procedure parameters like compelling output speed, recurrence and laser viable force on a superficial level unpleasantness and etching profundity. The label chi and direct relapse were utilized in the investigation. The examinations were agreement with a L9 symmetrical cluster dependent on S/N proportion for surface unpleasantness and etching profundity. It was discovered that output speed has measurably critical impact on both surface harshness and etching profundity. The sweep speed seemed, by all accounts, to be the fundamental compelling parameter for the two execution qualities. The test results demonstrated that speeding up diminishes both Ra and D. To limit Ra, the sweep speed ought to be chosen at a significant level (800 mm/s), though to boost D, the output speed ought to be chosen at a low level (200 mm/s). Furthermore a scientific model for surface harshness and etching was built up and assessed

PRINCIPLES OF LASER PRINTER PRINTING:

- Ideation is the first and most significant advance of the laser etching process. It's up to you, the craftsman, to choose what it is you might want to etch and the sort of material that you might want to utilize. Laser etching is a profoundly flexible technique. You can utilize stone, glass, plastics, covered or non-covered metals, and

characteristic substrate like wood as your material, and the choices for what precisely to imprint are just constrained by your own innovativeness. You can discover extraordinary task thoughts all finished – have a go at drawing motivation from your condition, or check out the web for certain ventures that may intrigue you.

- Once you have a good thought, you can begin your laser etching venture by structuring your ideal picture or content. Plan for laser printers is done on PC programs, yet it's essential to guarantee that the laser etching machine that you mean to utilize is perfect with the records produced by your decision of structure programming. Some laser etching machines accompany their own product, while others are intended for similarity with existing programming alternatives, similar to Adobe Illustrator. When your structure is done, it will be sent to the laser etcher through the printer discourse.
- Presently it's a perfect chance to place your picked materials into the laser scratching machine and pick what settings you need to utilize. Contingent upon the laser etcher and programming, you can control the quality of the laser, profundity of the cut, the speed, number of passes, line thickness, and different factors. It is suggested that you test your materials under a wide range of conditions to figure out what settings give the ideal outcome.



Fig1: gray scale model for engraving

- Once you've made sense of the settings you need and set some new materials in the laser etching machine, it's an ideal opportunity to press the beginning catch and watch the laser etching machine produce your one of a kind structure. This is the great part!
- When the laser is done etching your structure into the ideal material, you can feel free to expel the material from the machine. It's just as simple as that

FINISHING

Since you comprehend the fundamental strategy for making your own laser etching venture, you may in any case be thinking about what really goes on inside the laser etcher – how does the machine really work?

- A laser etching machine is a machine that utilizes complex parts and techniques to finish a generally straightforward assignment – moving information from a plan record onto a physical item. Laser etchers have three fundamental parts – the laser, the controller, and the surface. The laser resembles the "pen" or "pencil" – the item really makes the structure by concentrating powerful light onto the "surface"

PROCESS



Fig 2 images engraved on surface

- If the surface material is disintegrated during laser etching, ventilation using blowers or a vacuum siphon are quite often required to evacuate the poisonous vapor and smoke emerging from this procedure and for expulsion of flotsam and jetsam on a superficial level to permit the laser to keep etching.
- A laser can clear material capably because the laser shaft can be expected to pass on essentialness to the surface in a manner which changes over an elevated level of the light imperativeness into heat. The column is significantly connected with and collimated in
 - A laser etching machine comprises of three primary parts: a laser, a controller, and a surface. The laser is a drawing instrument: the bar transmitted from it permits the controller to follow designs onto the surface. The controller decides the bearing, power, speed of development, and spread of the laser bar focused on a superficial level. The surface is picked to coordinate the sort of material the laser can follow up on.
 - There are three primary kinds of etching machines. The most well-known is the X-Y table where, as a rule, the work piece (surface) is fixed and the laser optics move around in two measurements, guiding the laser bar to draw. Some of the time the laser is fixed and the work piece moves.
 - Sometimes the work piece moves in a single hub and the laser in the other. A subsequent classification is for barrel shaped work pieces (or level work pieces mounted around a chamber) where the laser viably navigates a fine, while on- off laser beating produces the ideal raster picture. In the third classification, both the laser and work piece are fixed and galvo mirrors move the laser bar over the work piece surface. Laser etchers utilizing this innovation can work in either raster or vector mode.
 - The point where the laser pillar contacts the surface ought to be on the central plane of the laser's optical framework and is typically equal with its point of convergence. This point is commonly little, maybe not exactly a small amount of a millimeter (contingent upon the optical frequency). Just the region inside this point of convergence is altogether influenced when the laser pillar disregards the surface. The vitality conveyed by the laser changes the outside of the material at the point of convergence. It might warm up the surface and in this way disintegrate the material, or maybe the material may crack (known as "glassing" or "glassing up") and drop off the surface. Slicing through the paint of a metal part is commonly how material is laser engraved. Most non-astute materials. Like wood, plastics and veneer surfaces, the change of light vitality to warm is more than some productive. In any case, due to this proficiency, the gear utilized in laser etching may warm up rather rapidly. Expound cooling frameworks are required for the laser. On the other hand, the laser pillar might be beat to diminish the measure of over the top warming.
 - Since the situation of the laser is known precisely by the controller, it isn't important to add obstructions to the surface to keep the laser from going astray from the endorsed etching design. Subsequently, no resistive veil is required in laser etching. This is principally why this strategy is unique in relation to more established etching techniques.

3. MATERIALS REQUIRED

- FRP Material
- MDF Board
- Plastic
- Glass
- Acrylic Material

4. MECHANISM OF LASER PRINTER

A laser etching machine comprises of three principle parts: a laser, a controller, and a surface. The laser is a drawing device: the pillar transmitted from it permits the controller to follow designs onto the surface. The controller decides the bearing, power, speed of development, and spread of the laser bar focused on a superficial level. The surface is picked to coordinate the sort of material the laser can follow up on.

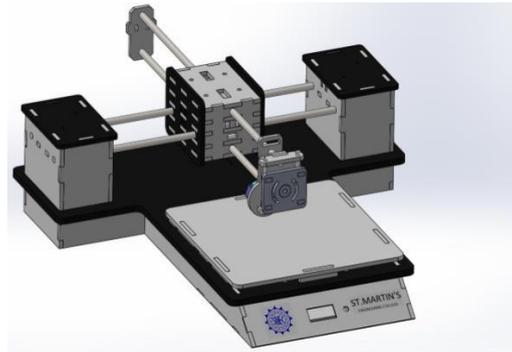


Fig.3 mechanism of printer

There are three principle classifications of etching machines. The most widely recognized is the X-Y table where, normally, the work piece (surface) is fixed and the laser optics move around in two measurements, guiding the laser shaft to draw vectors. In some cases the laser is fixed and the work piece moves. Here and there the work piece moves in a single pivot and the laser in the other. A subsequent kind is for round and hollow work pieces (or level work pieces mounted around a chamber) where the laser viably crosses a fine helix while on-off laser beating produces the ideal raster picture. In the third classification, both the laser and work piece are fixed and galvo mirrors move the laser pillar over the work piece surface. Laser etchers utilizing this innovation can work in either raster or vector mode.

5. SOFTWARES

They are some of the software's to be used for laser printing for their performance.

Nebarnix

Specifications of the software

- **Laser Min Power** [0-255]: - This is the laser power that relates to WHITE
- **Laser Max Power** [0-255]: - This is the laser power that relates to BLACK
- **Laser 'Off' Power** [0-255]: This is the laser power that won't mark the wood by any means, regardless of whether it just stays there. Normally this is the absolute minimum that your PWM board will react to.
- **Skip over values above** [0-255]: This defines the white level. In a JPEG the white level probably contains some compression artifacts so you might have to go down to 252 or so. PNG images should have white at 255 so 254 is a good value. (TODO: preview the image with this level hi-lighted)
- **Travel (noncutting) Rate** [mm/min]: - Slewing between places speed.
- **Scan (cutting) Rate** [mm/min]: Speed to move while lasering. This is usually limited by the commands per second rate of your firmware, you can go faster from an SDcard than over USB. You will need to find this speed, and note that the power levels will need tweaked if this speed is changed.
- **Overscan Distance** (prevents twang from showing) [mm]: - This sets a 'blank' distance before the start of the line to give the belts time to settle down and the motors to reach constant speed.
- **Height** (width autocalculated) [mm]: - set the height, the script will autosize the width. (TODO: add an either/or option)
- **Horizontal Resolution** [mm/pixel]: **Scangap** - mm between pixels. If you make this larger you can attain faster speeds, but at the price of some detail loss. 0.1 is really amazing 0.15 is nearly so. 0.2 starts to look a little fuzzy. Beyond that you will probably see pixelization.
- **Scangap** - [mm/line]: - This is the separation between lines which is a component of your laser spot size. You have to make this sufficiently little so there aren't noticeable unburned lines. For my laser this is 0.05 however I can normally pull off 0.075 in light of the fact that its quicker. 0.1 leaves noticeable lines, which is somewhat of a cool impact. You can attempt to defocus your laser to make thicker lines for shorter in general all out time, yet you

should expand your capacity. Note that if lines begin to cover you may need to cut your shut down somewhat.

- **Start X** [mm from 0 for right of image]: - X value to start image from. The laser will start here and move in the positive direction as it scans. These X,Y points correspond to the top right of the image.
- **Start Y** [mm from 0 for top of image]: - Y value to start image from. The laser will start here and move in the positive direction as it scans. These x, y points correspond to the top right of the image.

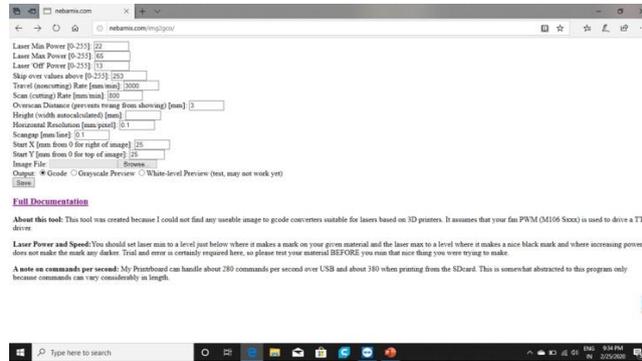


fig 4 software menu

Pronterface

- **Pronterface** is a laser printing host – a program that allows direct control of laser printers (including printing a sliced gcode) through a USB cable. Pronterface is a part of Printron, a free, open-source software suite.
- It is basic software which is used to control the printer or to operate the laser machine

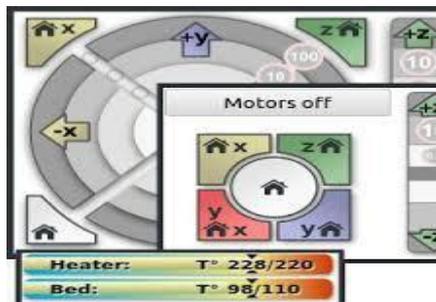


Fig:5 Control system of axis

- Here these are the co coordinate control system which helps in the control of the x and y axis of the printer and there is no z axis in the performance

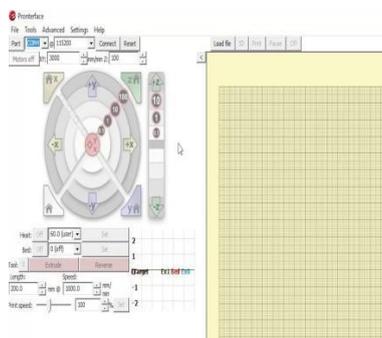


Fig: 6Set up page

- Here is the setup page which is to lode the image from the file which is converted in to the g code file formate
- At the point when you're finished setting up Print run, you can begin pronterface.py in the registry you unloaded it. Select the port name you are utilizing from the main drop-down, select your baud rate, and hit

associate. Burden a STL or GCODE record, and you can transfer it to SD or print it legitimately. The "screen printer" work, when empowered, checks the printer state (temperatures, SD print progress) at regular intervals. The order box perceives all pronsole orders, yet has no tab finish.

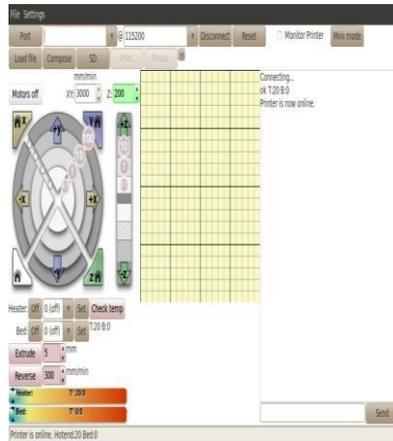


Fig:7 Over view of the software with inserted image.

FIRST TRIAL:

The first trial was made using wooden sheets under following settings

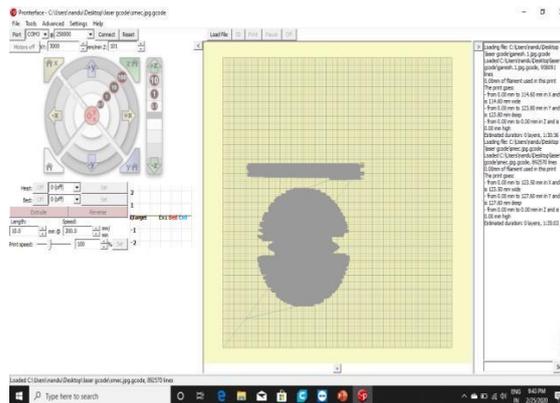


Fig 8 installed image

OBSERVATIONS:

- The power of the laser was set to be in 30%
- The smoke can be control quickly.
- The time taken for first trial was depending on size of image and work piece
- The flow of air should be required to exit the smoke in small quantity

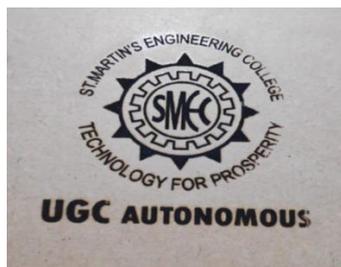


Fig: 9 image after performance

CONCLUSIONS FROM 1ST TRIAL:

- There should be no disturbance of work piece in between the process
- That should be placed properly and fit to the machine
- Regular air flow should be needed

SECOND TRIAL:

The second trial was made using FRP sheets under following settings

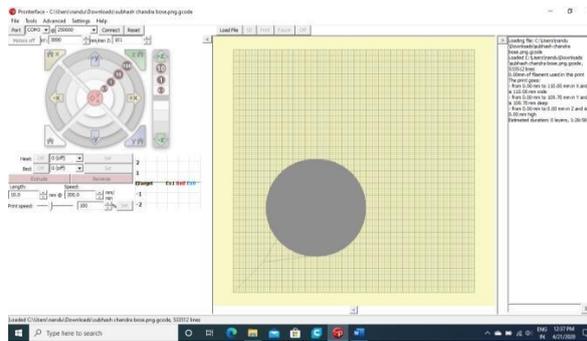


Fig 10: Second Trial image by changing temperature

OBSERVATIONS:

- The second trial took more time to print the object.
- The speed settings also reduced based on sheet required.
- Maximum thickness will burned with respect to speed and laser power.
- The layers were found to be sticky and by thus the building of the object is made.



Fig 11 image on frp material

CONCLUSIONS FROM 2ND TRIAL:

- The improvements were made on second trial by using different material and power
- The required power of laser diode for this is more than 50%.
- Few issues were found in printing while operated without fan.

6. CONCLUSION

From the overall work carried out in design and development sections Of the laser engraving machine, the final structure of the machine is made Physically and set to work with the laser module under all the required. Criteria to print a 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.

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