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WOOD LASER MARKER/ENGRAVER

Engineering

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ABSTRACT

Nowadays people consider gifting a wooden frame with art on it rather than some costly gift. This paper describes how digital art can be engraved on a piece of wood and be framed for gifting and exhibitions. Digital art consists of drawings like Mandala art, Zentangle designs or any complex drawings which can be drawn or downloaded on an iPad or a computer in the form of an image. Later, it can be engraved on the wood and the artist doesn't have to draw the same design many times like on the paper. Once the digital drawing is ready, the person can engrave it more than a thousand times using the Wood Laser Marker/Engraver.

KEYWORDS

Laser engraving, X-Y axis plotter, engraving machine, laser marking

INTRODUCTION

Laser engraving is the removal of material from the top surface down to a minimal depth. Laser engraving, which is different from laser marking, is the method of using lasers to engrave an object. Laser marking on the other hand just discolours the surface, without disintegrating the surface.

Wood Laser Marker/Engraver, as the name suggests is used to engrave designs or calligraphy writings on a wooden piece. Principle of the machine is etching the material using a laser module. The surface where the laser is incident is disintegrated resulting in engraving the design which input on the computer. Laser engraver consists of various IOT based hardware and software components. The working model of laser engraver can be used commercially with minimal training. This machine can be used for laser engraving as well as laser marking.

II. MATERIALS AND METHODS

Laser printing is process of printing on a surface using laser. Laser power can be varied with respect to the requirements of the surface and depth of printing.

1. Assembly

The idea is of having two axes, X-axis and Y-axis. Laser module faces the horizontal plane. The movement of the laser system is supported by two linear rail guides which are mounted with one stepper motor on each of the rails. The system is designed to work on 12V DC, and an Arduino UNO integrated with a CNC shield with stepper motor drivers.

The whole assembly is mounted on a wooden platform for better portability.

Components used:

Arduino UNO:

It is one of the most widely used microcontroller boards based on ATmega328P for small scale applications.

CNC Shield:

This component connects the motors and laser module to the computer via the Arduino UNO's I/O ports. It commands the motors with the help G-codes.

Stepper Motor:

NEMA 17 with 1.8 degree of step angle and 4.2 kg-cm of torque. We have two motors, one on X-axis, one on Y-axis.

DRV8825 stepper motor driver:

It is connected to the CNC shield and it helps with the movement of the motors along both the axes. They have a heat sink attached to them for longer uses of the machine.

Laser Module:

The laser module has a wavelength of 445nm and laser power is 3000mW. It works on 12V DC power supply.

Limit Switch:

These switches here play an important role of instant abortion of the current process. It resets the system just like an emergency stop button.

MGN15H Linear Rail:

The rails are of 500mm in length for each of the axes. They are mounted on the rails for the movement of the laser module. They are supposed to be oiled every now and then for frictionless movements.

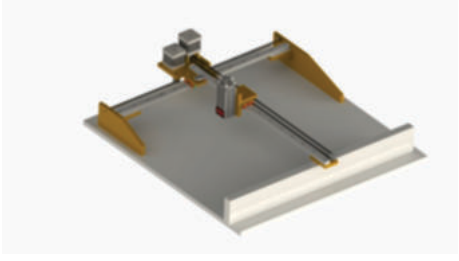

Fig 1: Virtual design of the proposed model

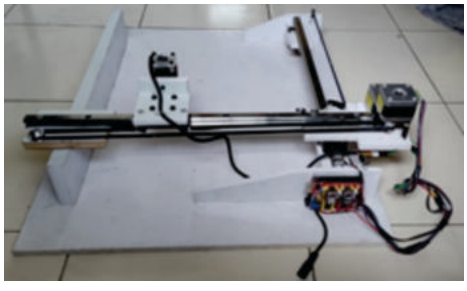

Fig 2: Assembled Design

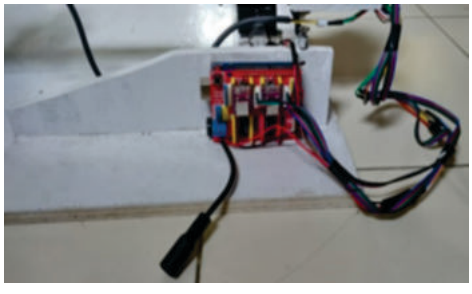

Fig 3: Electronic components of the model

2. Processing
The process of printing starts with input of 12V DC. It provides power to the Arduino UNO, CNC Shield, stepper motors and laser module. The processing block commences with the software which converts the input image to G-codes and the laser module engraves it.

Software components:
- Arduino IDE: It is an IDE used for the communication of the Arduino UNO with the computer.
- LaserGRBL: This software communicates with the laser module and motors via the communication port used by Arduino UNO

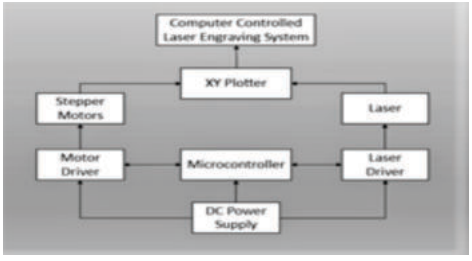

Fig 4: Block Diagram of the system

Hardware components:
DC Power Supply:
We require a 12V DC supply for the system to work.

Microcontroller:
Arduino UNO consists of microcontroller.

Laser Driver:
CNC Shield consists of Laser Driver.

Motor Driver:
CNC Shield consists of Motor Driver.

XY Plotter:
It synchronises the laser module and motor mechanism which results in engraving.

Laser engraving system:
Emission of laser for engraving. The power can be adjusted through the LaserGRBL software.

III. RESULTS AND DISCUSSION
The input image is taken in the form of .jpg or .png to LaserGRBL software which converts the image to G-codes that can be understood by the CNC shield. So, it guides the laser and motor mechanism in synchronisation to engrave the design.

The design when being engraved is not to be seen with our naked eyes to prevent eye irritation due to the radiation emitted by the laser.

Fig 5: Input image convert to Line-by-Line Tracing

Fig 6: Engraved surface after the execution.

Existing research suggests no use of wooden base or wooden support for the free end of the Y-Axis as used in this project (refer Fig 1). But when the project was assembled according to the existing research, it was unstable due to vibrations of the motors and weak supports. This is reason for the changes made in this project.

We have added the base to prevent the movement of the machine due to stepper motor vibration and the wooden support at the end of Y-axis as the rail bends downwards due the weight of the laser and movement block used on the rail guide.

IV. CONCLUSION
This research paper presents a wood laser engraver comprised of low-cost elements. After the modifications made in the design, it works smoothly without any instability. The goal of the assembly is to make the previous version of design more stable and smooth for the processing.

V. Acknowledgements
We would like to express our sincere gratitude to Prof. Aarti Sawant, our project guide and research supervisor for their guidance, enthusiasm and useful critiques of this research.

The PLC and Arduino UNO can be synchronised using external timers and limit switches. The research is in progress for the same.

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