e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:04/April-2022 Impact Factor- 6.752 www.irjmets.com

LASER ENGRAVER AND LASER CUTTER

Faiyaz Mansoori[*1], Adesh Tayde[*2], Mohammad Sadique[*3], Faizan Akhtar[*4], Bazil Sheikh[*5], Akbar Ali[*6]

[*1,2,3,4,5]Student, Department Of Electronic And Telecommunication Engineering, Anjuman College Of Engineering And Technology, Nagpur, Maharashtra, India.

[*6]Assistant Professor, Department Of Electronic And Telecommunication Engineering, Anjuman College Of Engineering And Technology, Nagpur, Maharashtra, India.

ABSTRACT

The major goal of this project is to document the development and testing of a variety of components for use in a low-cost laser cutting mechanism for hobbyists and recreational designers. Various circuits were used to test the cutting capabilities of a laser diode, a small silicon chip-based laser light producing device. Multiple experiments were carried out on various materials using a test rig constructed to analyse the laser diode's cutting capability. The practicality of using a potentiometer for position feedback was also assessed using a low-cost positioning machine design that used servo motor actuators to control the system. Experiments with the laser diode using various cutting techniques revealed that the diode's cutting capability is restricted. Tests with the laser diode using various cutting techniques indicated that the diode's cutting capacity is restricted and that it is unlikely to be well suited for cutting through materials of sufficient structural thickness (0.125 inch to 0.25-inch-thick materials). The results of the potentiometer feedback testing were favorable, demonstrating that it is a suitable low-cost position control approach. The mechanical designs tried, however, were insufficient for placing the device to within 0.01 inches of the requested coordinates, necessitating additional development.

I. INTRODUCTION

Since the advent of the first machines capable of producing laser light, the idea of utilising lasers to cut material has been around. The capacity to utilise lasers to cut a variety of materials is a reality today and an interesting area of industrial processes that is continually changing and expanding, as shown in science fiction. Laser cutting machines have recently reached a stage where they are being used not just in manufacturing facilities, but also at colleges and other design businesses, particularly those specialising in architecture, graphic design, and product design. Laser cutting machines are used in industrial facilities to swiftly produce items composed of various plastic and metallic materials. Laser cutters are used as prototype devices at institutions such as colleges and design businesses. Because of the high precision provided by a commercial laser cutter, as well as the relative ease of designing parts in solid modelling software and transferring that data to the laser cutting machine, using a laser cutter greatly reduces the time between designing a prototype and receiving the fabricated parts. By being able to construct several prototypes with varied adjustments at each stage of the journey, this decrease in time aids the prototyping process. Engineers and educators in the field of mechanical design have realised the value of laser cutting equipment during the prototype stage of the design process.

II. METHODOLOGY

Laser engraving is used to engrave a specific image or trademark onto a chosen material. It's a subtractive technique of production. However, before the engraving process can begin, a file from a computer must be transferred to the machine's controller, which then sets the laser. When the Laser Engraving process begins, the beam generates a large amount of heat, which burns or evaporates the surface in accordance with the picture in the file. There are two types of engraving: line engraving and surface engraving. The first employs vector pictures to follow routes or lines, while the second vaporises the material to embed an image or give the design a three-dimensional appearance. For Laser Engraving, what kind of file do you need? Any 3D files, such as. stl, cannot be read by laser engraving devices. As a result, you must utilise 2D file formats such as jpg, pdf, png, or ai. The file's model will be turned into dots, and the distance between them will define the depth of the engraving.

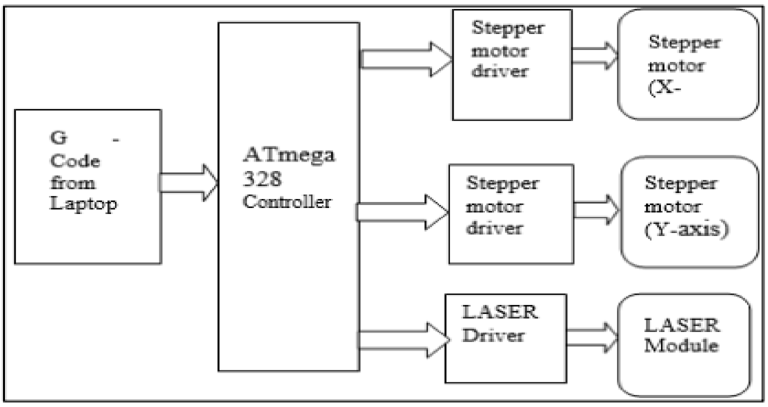

Fig 1: Block Diagram of Laser engraver

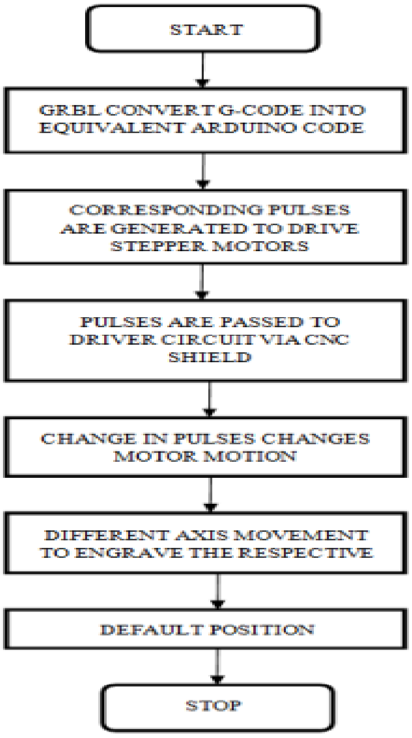

Fig 2: Flow Chart of Laser Engraver

Fig 3: Ardiuno uno

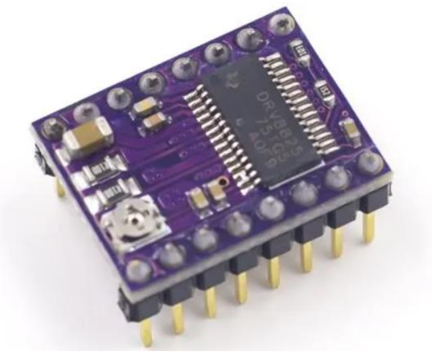

Fig 4: Stepper Motor Driver Module

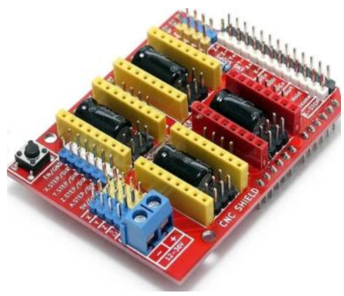

Fig 5: CNC Sheild

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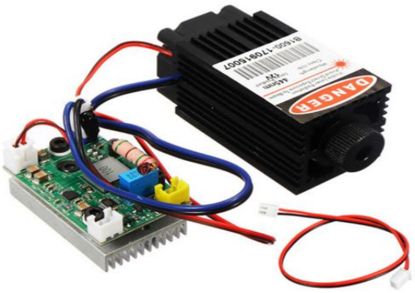

Fig 6: Laser Module

III. RESULTS AND DISCUSSION

It is critical to consider appropriate space for the machine work head, both for the 3D printer dosing system and for the laser module, while constructing a printer and for future consideration of the interchangeable head. This is usually rather huge, depending on the machine's installed power. An aluminium cooler with forced cooling provided by a fan makes up a substantial portion of the module. However, in most circumstances, the dosage mechanism will be larger than the laser module. The design of 3D printers is solved such that the print nozzle's axis crosses through the z-axis, establishing the print head's centre. In each axis, the print area and print head feed size are adjusted to allow the print nozzle to travel around the whole workbench surface (heat bed). As a result, it's critical to align the laser module axis, through which the laser beam passes, with the print nozzle axis, or as close to each other as feasible, in order to maximise the workspace's potential. The clamping mechanism is also well-designed, allowing both the print mechanism as a whole and the laser module to be fastened. A viable option, for example, is to use the shaped contact to attach a unit to one section of the printing platform and a bolt to the other.

Characteristics of voltage and current Like conventional diodes, laser diodes have voltage-current characteristics. Figure 7. Depending on the material used for the diode, a substantial current can only flow above a specific critical voltage. The current develops fast in tandem with the voltage over the critical voltage. Laser diodes are not generally operated with a set voltage since the current can be quite sensitive to this voltage and can also be impacted significantly by the device's temperature. It might even harm the diode: a high current could produce a rapid rise in temperature, eventually causing the diode to fail.

IV. CONCLUSION

Although significant progress has been made in developing the components required for a low-cost laser cutting mechanism, the machine's capabilities will be limited beyond its original goals. The machine would be limited to cutting thin (0.040-inch thicknesses and thinner) material entirely through using the laser diodes investigated in this thesis. The laser diode's low power outputs are the key limiting factor in the laser's cutting capabilities. Although adding more lasers focused on the same place improves performance, there are certain drawbacks to this strategy.

The mechanical structures investigated in this thesis provide a suitable starting point for creating a low-cost machine capable of precise placement, but further development is required before the machine can achieve its design objectives.

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