

GRBL-based motion control and a laser control board ensured smooth operation and consistent engraving quality. Despite the absence of wireless connectivity, the USB-based control system allowed for stable communication and easy operation. The machine successfully processed G-code instructions from LaserGRBL and Inkscape, producing clear and well-defined engravings. However, improvements such as chassis reinforcement, a higher-power laser module, and better cooling mechanisms could further enhance performance. Overall, this low-cost, Arduino-based laser engraving machine provides an efficient and accessible solution for small-scale engraving applications. With further refinements, it has the potential to be used for customization, hobby projects, and small business applications, making laser engraving more affordable and practical.

Fig 9. CNC Laser Engraving Machine

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Fig 10. Engraved Product

V. CONCLUSION

The design and fabrication of a portable laser engraving machine were successfully implemented using an Arduino Uno, GRBL firmware, stepper motors, and a 1W laser module. The system effectively performed precise engraving on materials like wood, acrylic, and cardboard, demonstrating accuracy and reliability. The wooden chassis provided a lightweight and cost-effective structure, though minor vibrations were observed at higher speeds. The integration of