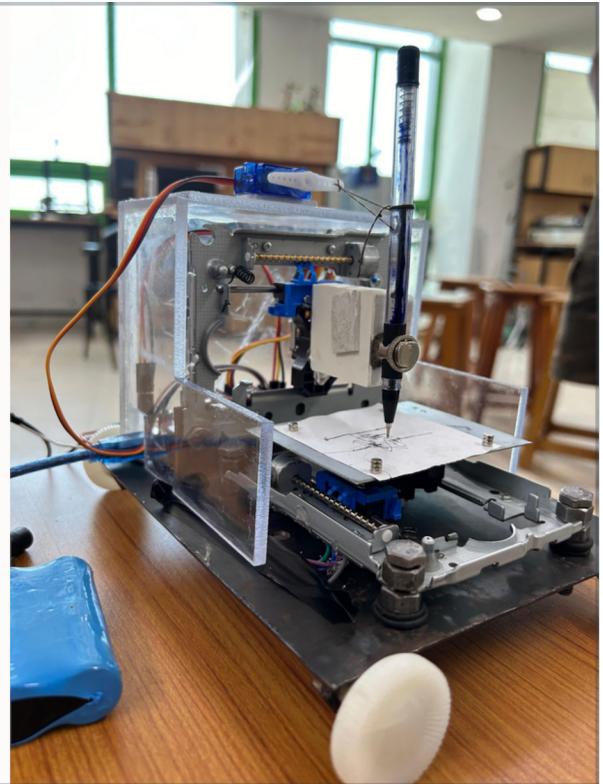




DESIGN LAB-1 PROJECT

CNC 2D PLOTTING MACHINE

**PRESENTED BY-
GROUP - FRIDAY B**



Group Members

Vaibhav Mehta
2022MEB1360

Sumer Singh Bassi
2022MEB1351

Surendra Kumar Meena
2022MEB1354

Aman Tadavi
2022MEB1355

Tanushka Kumari
2022MEB1357

Contributions

Vaibhav Mehta

- Assembled the CNC plotter's mechanical components, including structure, servo motors, dvd writers, and CNC V3 shield.
- Assisted in coding by contributing to the GRBL firmware setup and Universal Gcode Sender configuration.

Sumer Singh Bassi

- Focused on coding, specifically setting up and configuring the GRBL firmware to work with the Arduino UNO and CNC V3 shield.
- Supported the assembly process by helping with the construction and securing of the CNC plotter's structure.

Surendra Kumar Meena

- Designed the case using solidworks
- Logistics

Aman Tadavi

- Assisted with soldering, wiring
- Logistics

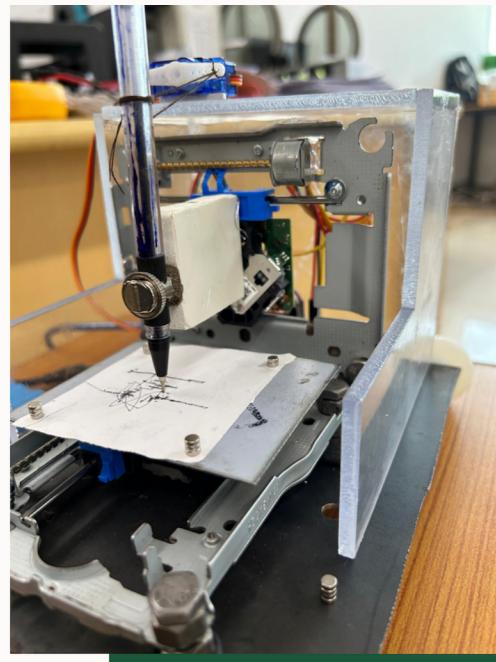
Tanushka Kumari

- Made pen and pen holder
- Logistics

PROBLEM STATEMENT

We were assigned CNC Plotter as our **ME-205 Design Lab-I** project.

In this, we designed 2D Computer Numeric Control (CNC) plotter using Arduino, mechanical components (like old DVD Writers,etc.)



Working Principle

The core principle behind our 2D CNC machine is the conversion of digital design data into precise control instructions for the machine's movement along two axes, X and Y. By using computer-generated designs, our CNC machine translates these instructions to accurately move the tool(pen) over the surface of paper, and prints intricate designs on paper's surfaces.

A CNC 2D plotter machine using CNC Shield v3 and GRBL Arduino operates by interpreting G-code commands sent from a computer to control stepper motors through the CNC shield v3, precisely positioning the plotter's tool (pen or marker) along X and Y axes to create designs.

Working Mechanism

OLD/ USED DVD WRITERS

Old DVD writers are repurposed in CNC 2D plotting machines for precise stepper motor control. They interpret signals from a microcontroller/computer, using PWM to move the pen/tool accurately along X and Y axes, enabling drawing or engraving.





ARDUINO UNO

The Arduino in a CNC 2D printing machine acts as the central controller, receiving instructions from a computer, controlling CNC Shield V3 and then stepper motors, and executing G-code to precisely move the machine along X and Y axes for accurate printing.



SERVO MOTOR

In a CNC 2D printing machine, servo motors provide precise control over movement. They receive signals from the controller (like an Arduino), rotate to a specific angle, and hold that position. This accuracy ensures precise positioning of the machine's components (pen), resulting in accurate printing.



STEPPER MOTOR

Stepper motors are used in CNC 2D plotter machines for precise control of the tool's position along the X and Y axes. Their ability to move in discrete steps allows accurate positioning, essential for creating detailed designs. Stepper motors also offer high torque at low speeds, ensuring consistent and reliable operation during plotting tasks.



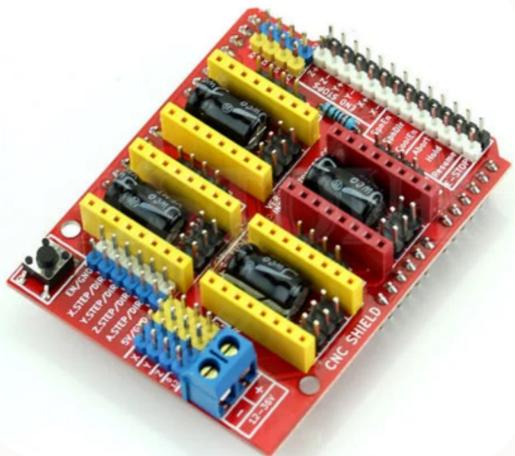
A4988 MOTOR DRIVER MODULE

The A4988 motor driver module is commonly used in CNC 2D plotter machines to control stepper motors. It interprets signals from the Arduino board, providing precise current regulation and step-by-step control to the stepper motors.



CNC SHIELD V3 PCB

The CNC Shield V3 (PCB) serves as an interface between the Arduino and stepper motors in a CNC 2D printing machine. It receives commands from the Arduino, interprets them, and directs the stepper motors accordingly, enabling precise control over the machine's movement along the X and Y axes for accurate printing or engraving.





GRBL (G CODE REFERENCE BLOCK LIBRARY)

GRBL (pronounced "garble") is an open-source firmware specifically designed for CNC machines like 2D plotters. It runs on Arduino boards and interprets G-code commands sent from a computer to precisely control stepper motors' movements along X, Y, and Z axes. With its compact size and efficient code, GRBL offers real-time responsiveness and high accuracy, making it ideal for CNC 2D plotting applications. It's highly customizable, allowing users to tweak settings to suit their specific machine configurations and requirements.

A large, bold, lowercase black font word "grbl" centered on the page. The letters have a slightly rounded, modern feel.



INKSCAPE

Inkscape 0.92 is a popular vector graphics editor used for creating designs for CNC machines.

The MI Grbl G-code extension is a plugin for Inkscape that generates G-code specifically tailored for Grbl-based CNC systems, including CNC 2D plotting machines, streamlining the design-to-machine process.





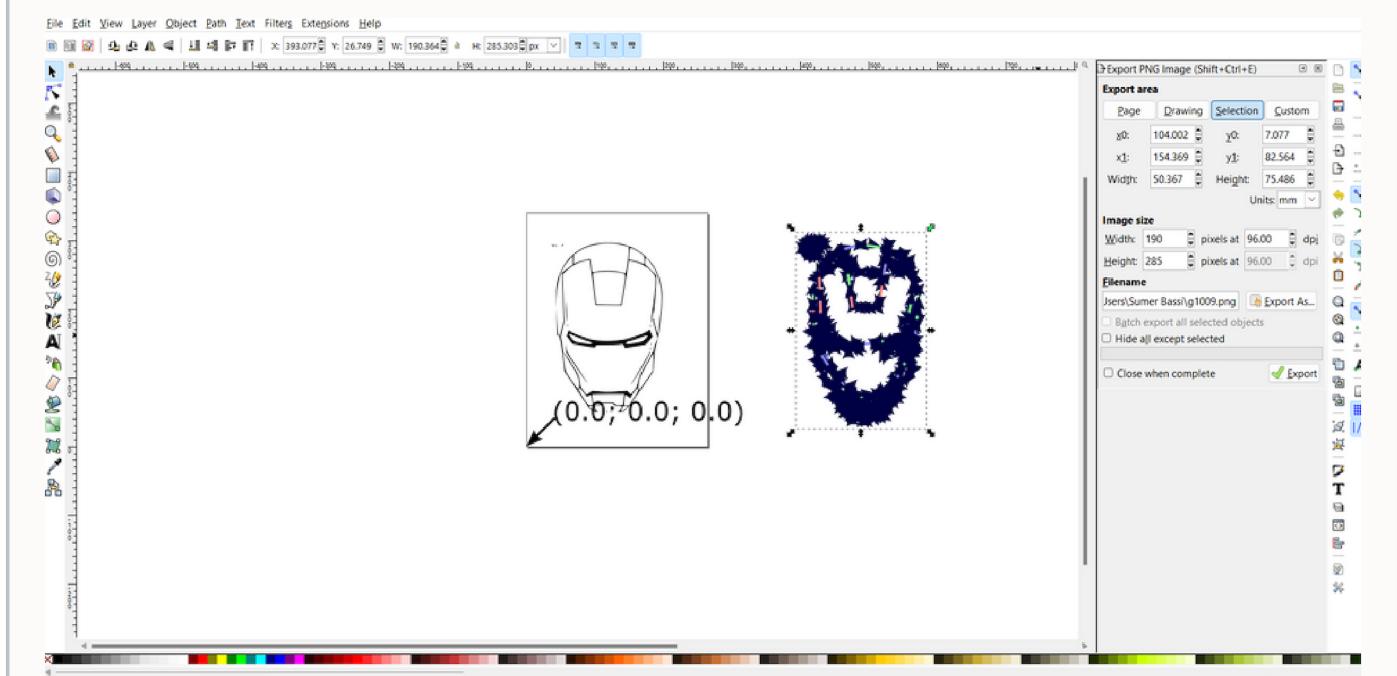
UGS

Universal Gcode Sender (UGS) 2.1.2 is a software tool commonly used in CNC applications, including CNC 2D plotting machines. It serves as a platform for sending G-code commands from a computer to the CNC controller, typically an Arduino running GRBL firmware. UGS provides a user-friendly interface for loading G-code files, controlling machine movements, adjusting settings, and monitoring the machining process.

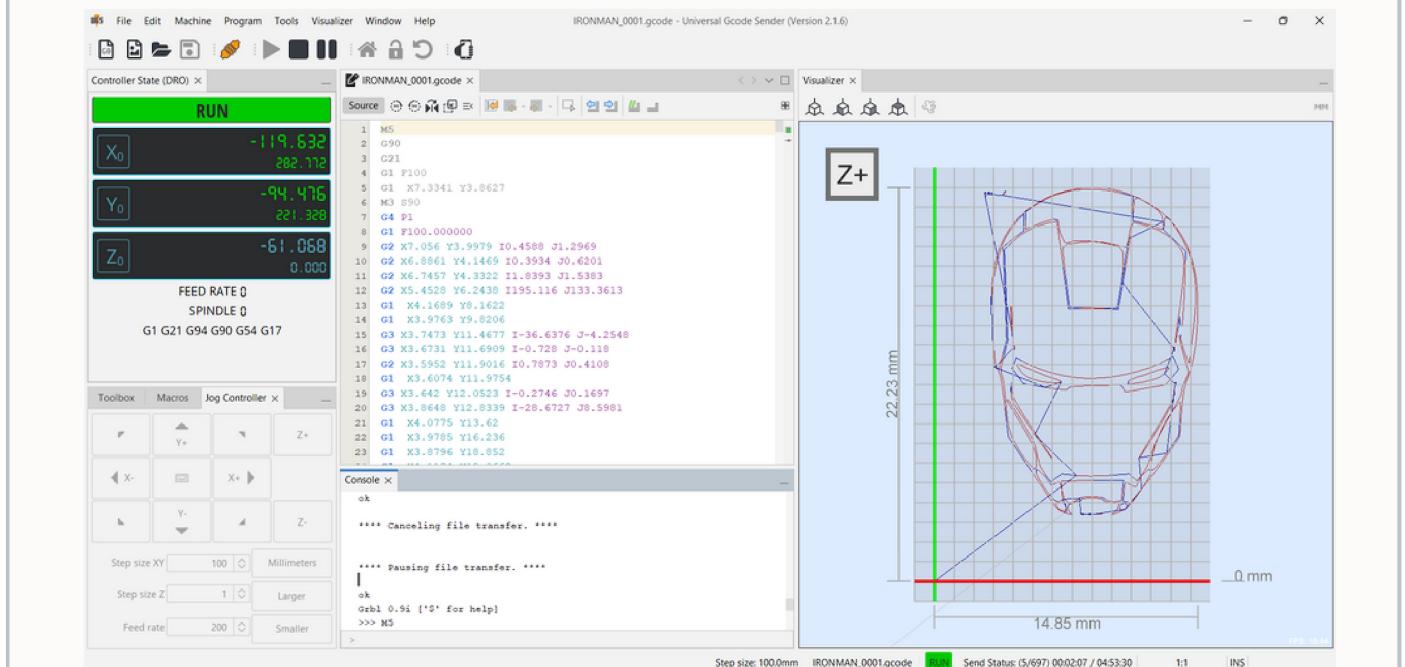


**UNIVERSAL
G-CODE
SENDER**

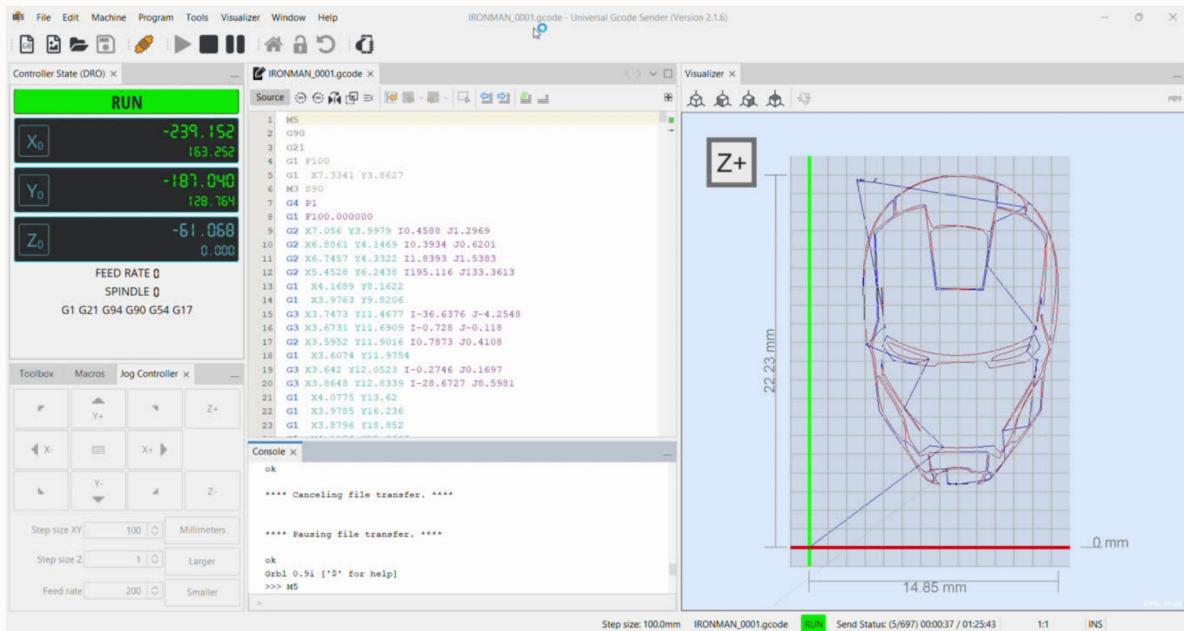
SNAPSHOTS



SNAPSHOTS



IMPLEMENTATION



DIFFICULTIES FACED

GRBL Compatibility Issue: The initial version of GRBL we installed on the Arduino UNO and CNC V3 shield was incompatible, requiring us to revert to an earlier version.

Error While Starting the Stream: During G-code transmission, we encountered a problem caused by an incorrect or missing configuration file in GRBL. This required replacing the existing config.h with another version.

Inkscape G-code Export Bug: We were unable to save the G-code files correctly due to a bug in Inkscape. This bug prevented measurements from being set in millimeters, forcing us to work with units in pixels instead.

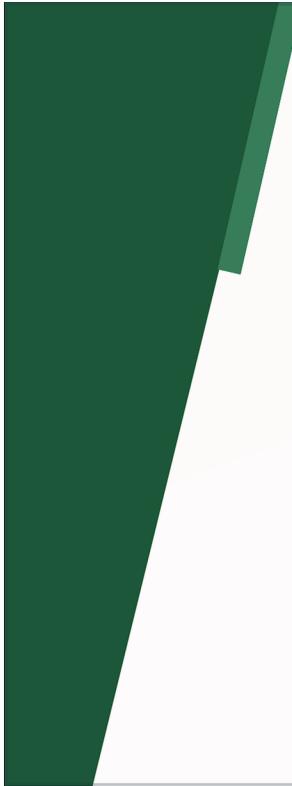


DIFFICULTIES FACED

Directory Management for GRBL: Uploading GRBL to Arduino required careful management of the installation directory. Incorrect paths led to complications during the upload process.

Port Detection Issue with Universal Gcode Sender: UGS initially failed to detect the communication port. We discovered this was because the Arduino IDE and UGS could not operate simultaneously on the same port. Closing the Arduino IDE resolved this issue.





THANK YOU