Sketchetron: Autonomous Artistic Robot

Introduction

The Sketchetron project challenges the notion that creativity is exclusively a human trait. This autonomous robotic system is designed to generate two-dimensional artwork on a designated surface without human intervention. By blending logic, engineering, and creativity, the project seeks to create a machine capable of performing artistic tasks.

Objective

The primary objective of Sketchetron is to design and construct an autonomous robotic system that can bridge the gap between mechanical precision and creative expression. The system should be able to independently generate artwork such as shapes, logos, and images, based on input designs.

Competition Rounds

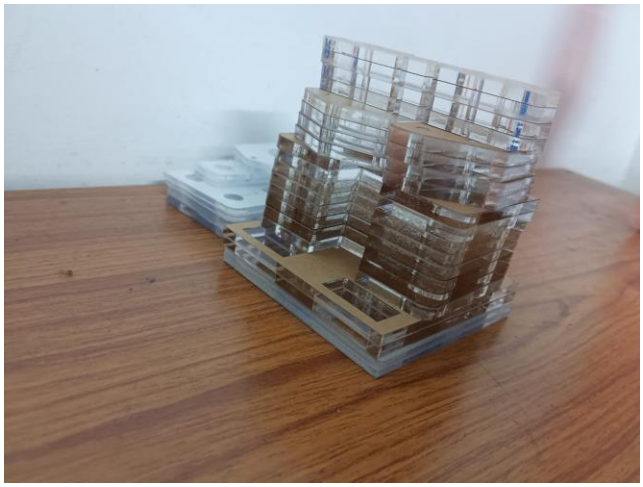
1. Round 1: Draw predefined shapes on an A3 sheet.
2. Round 2: Sketch the Robotics Club logo (15cm x 15cm).
3. Round 3: Sketch the image given to the team on the spot.

Bill of Materials

- 2 Nema 17 Stepper Motors
- 4 8mm Smooth Rods (two 400mm-long, two 320mm-long)
- 8 LM8UU Bearings
- 2 20-tooth GT2 Pulleys
- 10 F623ZZ Bearings
- 1 Micro Servo SG90
- 1 Arduino UNO
- 1 CNC Shield
- 1 GT2 Belt (1.4m)
- 2 M10 Threaded Rods (400mm)
- Various screws, nuts, and washers
- 1 12V 2A Power Supply
- 1 Pen Holder

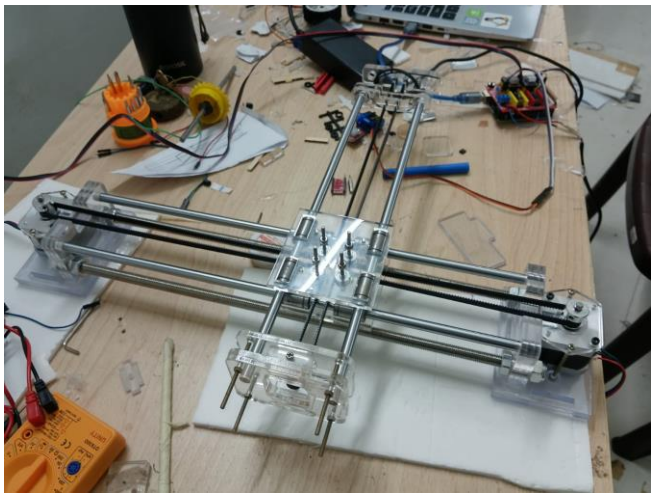
Designing the Frame and Laser Cutting

The frame for Sketchetron was designed with simplicity and structural integrity in mind, ensuring firm support for the entire system. To achieve precise dimensions and the desired shape, we utilized 6mm thick acrylic sheets, which were processed through laser cutting. This method allowed for accurate fabrication of the frame components, resulting in a clean and durable structure for the robot. YMWorks and other necessary software has been utilized.



Assembly Instructions

1. Slide two LM8UU bearings into each of the two longest smooth rods.
2. Install the rods into the motor support pieces on both sides, leaving 20mm protruding.
3. Insert M10 threaded rods to support each motor mount, using M10 nuts.
4. Mount Nema 17 stepper motors onto motor holders with M3 screws.
5. Insert LM8UU bearings into shorter smooth rods for the second axis.
6. Attach pulleys, belt, and the pen holder servo.
7. Complete assembly by mounting the Arduino UNO and the CNC Shield.

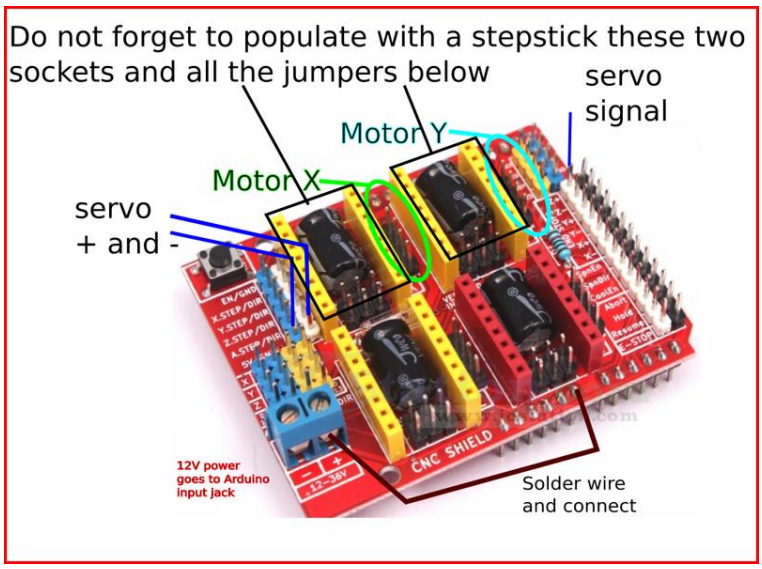


Arduino Software

Sketchetron uses a modified version of GRBL firmware to handle servo commands. The firmware is uploaded to the Arduino UNO, and the system is controlled through G-code commands sent via a serial interface.

Wiring Instructions

1. Attach the CNC Shield to the Arduino UNO.
2. Connect the stepper motors to the X and Y axis pins on the shield.
3. Connect the servo to digital pin 11 for pen control.
4. Power the system through the Arduino power jack.



Computer Software

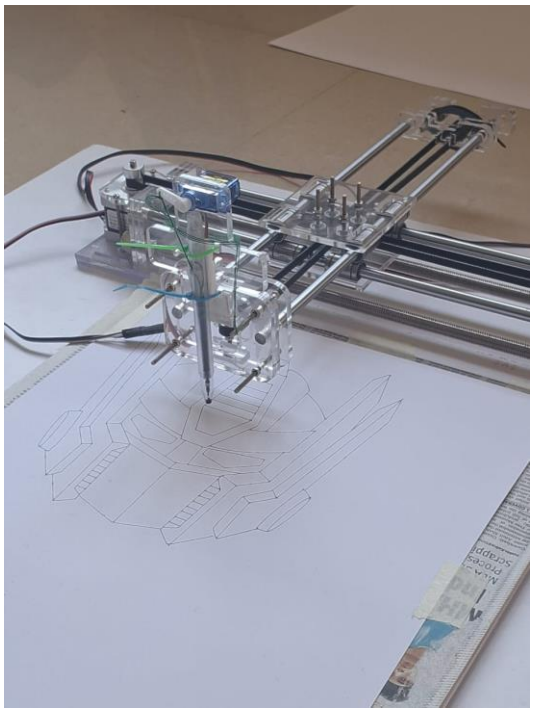
To create the G-code for the artwork, use Inkscape with a custom plugin to generate paths. The G-code is then sent to the Sketchetron using Universal Serial GCode Sender, which communicates with the Arduino and instructs the robot to draw.

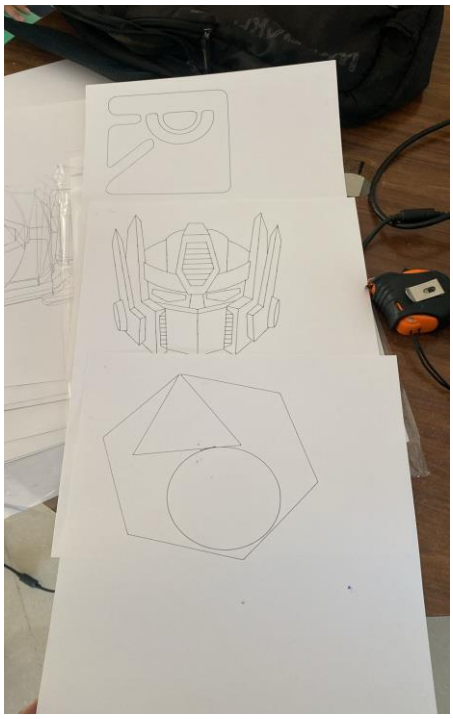
To operate Sketchetron, two software programs are needed. The first is Inkscape, a free vector drawing tool, which is used to create the design's G-code. Though installation can be tricky for non-technical users, it is essential for generating accurate vector graphics. The second program, Universal Serial GCode Sender (Java-based), allows you to send the generated G-code to the plotter for drawing.

Before drawing, the proper scale must be set in the Arduino UNO's EEPROM memory using the Universal GCode Sender terminal. Parameters $100 and $101 should be set to 80, reflecting the 200-step motor, 20-tooth pulley, and 2mm GT2 belt configuration. This ensures accurate reproduction of the Inkscape design.

Conclusion

Sketchetron demonstrates that robotics can be applied beyond utilitarian tasks and into the realm of creativity. This autonomous plotter robot is a fusion of engineering and artistic creation, showcasing the potential for machines to produce complex, original artwork.





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