

# EXPLORING EASY DRAW V3 2D PLOTTER MACHINE: A COMPREHENSIVE REVIEW AND ANALYSIS

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**Abstract-** With the advancement of technology, demand for 2D plotter machines in educational institutions and laboratories is rapidly rising. This research paper will present an affordable model of a 2D plotter machine capable of accurately and efficiently drawing 2D diagrams and images on small-sized paper using simple algorithms and readily available components. The '2D PLOTTER' is designed to be a low-cost three-axis 2D plotter utilizing stepper motors, V3 controller, and motor control software. Initially, users need to input an image into Inkscape software and then connect the machine to a computer to feed the image. The machine then plots the required image onto the paper using processing software and mechanical arrangements. Therefore, in our project, we aim to create an affordable 2D plotter of small or medium size with an open structure.

**Keywords:** Micro-Controller Unit (MCU), 2D plotter machines, Inkscape software, Sketching.

## 1. INTRODUCTION

A 2D plotter machine is a device used to create two-dimensional drawings or images on a flat surface, typically paper. It consists of a mechanism that moves a pen or other drawing tool across the surface in both the horizontal (x-axis) and vertical (y-axis) directions, allowing for precise control over the position of the pen. The machine is controlled by a computer or other electronic device, which sends instructions to the plotter regarding the desired drawing or image. These instructions typically include the coordinates of the points to be plotted and any other relevant parameters such as line thickness or color.

2D plotters are commonly used in various applications such as engineering and architectural design, cartography, and art. They offer advantages over traditional drawing methods such as increased precision and the ability to automate repetitive tasks. Additionally, they can produce drawings of larger sizes than may be practical by hand.

## 2. OBJECTIVES

The objectives of our project are to design and implement a 2D plotter machine capable of drawing plans, elevations, side views of buildings, and any required images on paper. Additionally, we aim to develop a low-cost automatic mini 2D plotter machine for drawing, reducing the cost of the mechanism while increasing flexibility.

## 3. METHODOLOGY

The current to the V3 controller using a USB DATA cable to transfer data from the computer to the V3 Board. We use two stepper drivers to supply the sequence to the stepper motors. The V3 controller is mounted at the side of the stepper motor, and the current is distributed under the command of the V3 controller. The V3 controller converts the command to the stepper motor. In the X-direction, the stepper motor moves left and right; in the Y-direction, it moves front and back; and in the Z-direction, it moves up and down. We have designed many complex models using this machine. The accuracy of these machine results is very high. Therefore, we use it in the industry to reduce the cost of design printing and maintain accuracy levels. Drafting and scaling of the 2D plotter machine are very precise.

## 4. SOFTWARE

### 4.1 Inkscape (Version 1.2.2)

#### 4.1.1 Vector Graphics Editing

Inkscape allows users to create and edit vector graphics, which are images defined by mathematical equations rather than pixels. This enables users to scale graphics without losing quality.

#### 4.1.2 User Interface

The interface of Inkscape typically consists of various toolbars, menus, and panels, providing access to different features and tools for creating and editing graphics.

#### 4.1.3 Drawing Tools

Inkscape offers a wide range of drawing tools such as the Pen tool, Bezier tool, Shape tools, Text tool, and more. These tools allow users to create complex shapes, paths, and text elements.

#### 4.1.4 Object Manipulation

Users can manipulate objects in Inkscape by resizing, rotating, skewing, and arranging them. Additionally, users can apply various transformations and effects to objects, such as gradients, patterns, and filters.

#### 4.1.5 File Formats

Inkscape supports various file formats for importing and exporting graphics, including SVG (Scalable Vector Graphics), PDF, EPS, PNG, and others. This makes it compatible with other graphics software and allows for easy sharing of files.

#### 4.1.6 Extensions and Plugins

Inkscape has a rich ecosystem of extensions and plugins that extend its functionality. These can include additional tools, effects, and export options, among other features.

#### 4.1.7 Community and Support

Being an open-source software, Inkscape has a vibrant community of users and developers who contribute to its development and provide support through forums, documentation, and tutorials.

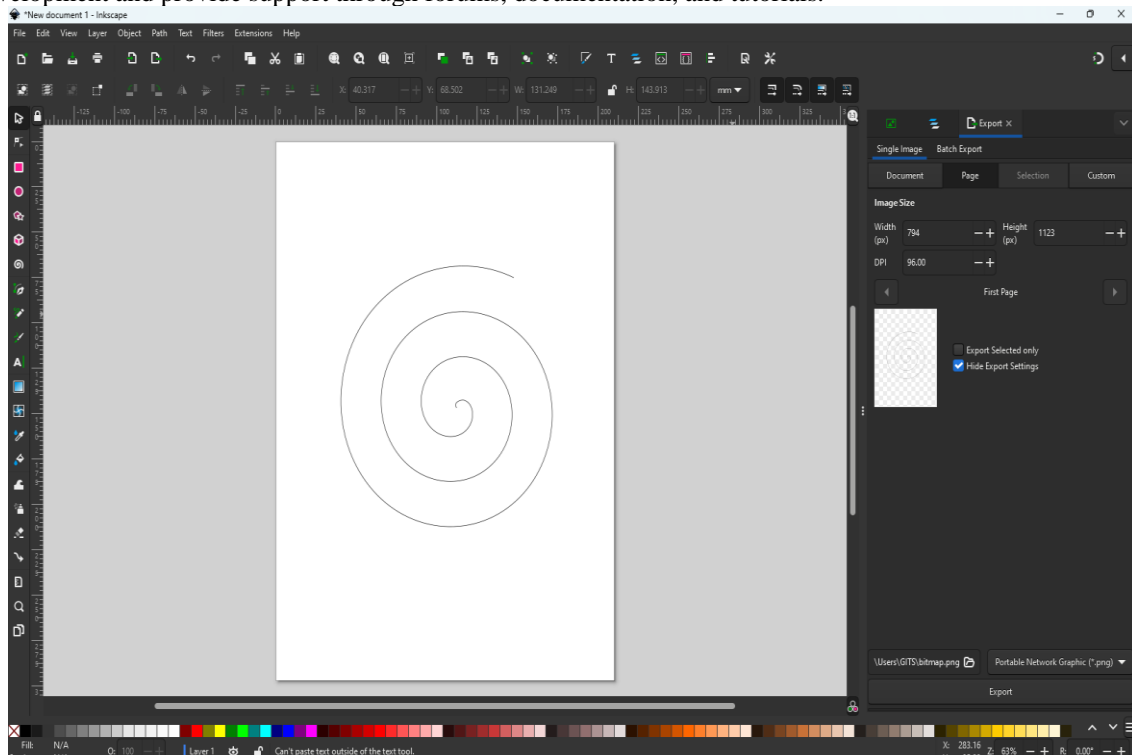


Fig. 4.1 Inkscape Window

### 4.2 Drawing Bot V3

#### 4.2.1 Control Interface

DrawingBotV3-Premium provides a user-friendly interface for controlling the 2D plotter machine. It typically includes options for selecting drawing parameters, uploading images, and initiating the drawing process.

#### 4.2.2 Compatibility

The software is designed to work with various types of 2D plotter machines, allowing users to easily connect their machines and start drawing.

#### 4.2.3 Data Transfer

DrawingBotV3-Premium facilitates data transfer between the computer and the plotter machine, enabling users to send drawing commands, images, and other instructions to the machine for execution.

#### 4.2.4 Stepper Motor Control

The software controls the movement of stepper motors in the plotter machine, allowing precise control over the positioning and drawing process. Users can specify the direction, speed, and distance of motor movements.

#### 4.2.5 Image Processing

DrawingBotV3-Premium includes features for processing images before sending them to the plotter machine. This may involve converting images to compatible formats, resizing, cropping, or adjusting image settings for optimal drawing results.

#### 4.2.6 Command Conversion

The software translates user commands and input into stepper motor movements and other machine instructions. It ensures accurate and reliable execution of drawing tasks based on user preferences.

#### 4.2.7 Accuracy and Efficiency

DrawingBotV3-Premium aims to deliver high accuracy and efficiency in the drawing process, allowing users to create precise and detailed drawings with minimal effort.

#### 4.2.8 Customization and Flexibility

Users may have options to customize drawing settings, adjust parameters, and fine-tune the software to meet their specific requirements and preferences.

### 5. HARDWARE DESCRIPTION

#### 5.1 Stepper Motor

A stepper motor is a type of DC motor which has a full rotation divided in an equal number of steps. It is a type of actuator highly compatible with numerical control means, as it is essentially an electromechanical converter of digital impulses into proportional movement of its shaft, providing precise speed, position and direction control in an open-loop fashion, without requiring encoders, end-of-line switches or other types of sensors as conventional electric motors require. The steps of a stepper motor represent discrete angular movements, that take place in a successive fashion and are equal in displacement, when functioning correctly the number of steps performed must be equal to the control impulses applied to the phases of the motor. The final position of the rotor is given by the total angular displacement resulting from the number of steps performed. This position is kept until a new impulse, or sequence of impulses, is applied.



**Fig. 5.1 Stepper Motor**

#### 5.2 Servo Motor

A servo motor is a specialized motor that provides precise control over its angular position. It consists of a regular DC motor coupled with a gearbox, control electronics, and a feedback mechanism such as a potentiometer or an encoder. Servo motors are commonly used in robotics, industrial automation, RC vehicles, and other applications that require accurate and controlled movement. They are favored for their ability to maintain a specific position even under varying loads and their responsiveness to input signals, typically provided in the form of pulse-width modulation (PWM).



**Fig. 5.2 Servo Motor**

A servo motor shown in fig. 5.2 is used for the movement of sketching pen in up and down in Z direction. This will help the 2D sketcher to point the pen in A4 sheet and withdrawing in front the sheet to stop drawing.

**5.3 Easy Draw Mini Board (V3 Controller)**

The Easy Draw Mini Board controller used in a 2D plotter is a compact and user-friendly interface designed to operate and control the plotter's movements and functions. Here's a breakdown of its features and functionalities:

**5.3.1 Compact Design**

The Easy Draw Mini Board controller is designed to be small and lightweight, making it easy to handle and manipulate during the plotting process. Its compact size ensures it can be conveniently mounted or placed alongside the 2D plotter without occupying excessive space.

**5.3.2 Intuitive Controls**

The controller features intuitive controls such as buttons, dials, or touch-sensitive surfaces, allowing users to navigate menus, adjust settings, and initiate various plotter functions with ease. These controls are strategically positioned for ergonomic access, enhancing user efficiency and productivity.

**5.3.4 Movement Control**

One of the primary functions of the Easy Draw Mini Board controller is to facilitate precise control over the plotter's movements. Users can use the controller to adjust the plotter's position along the X and Y axes, controlling the direction and speed of movement to achieve accurate plotting results.

**5.3.5 Pen Control**

The controller enables users to control the pen or drawing tool attached to the plotter, allowing them to raise, lower, or adjust the pressure of the pen as needed. This functionality is essential for initiating drawing strokes, lifting the pen during non-drawing movements, and customizing drawing effects.

**5.3.6 Drawing Modes**

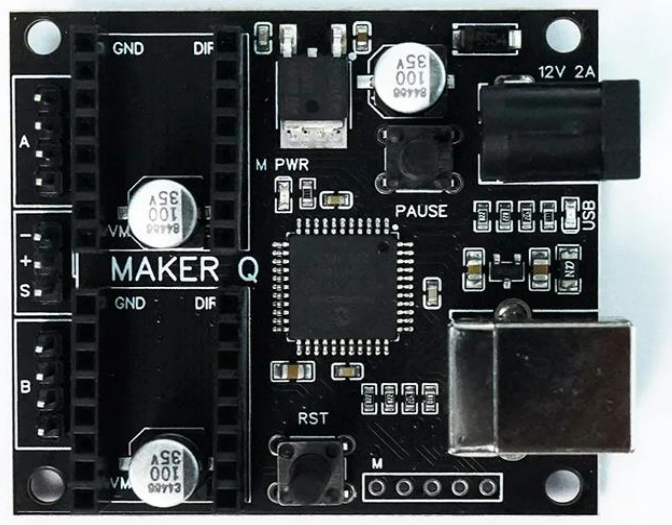
The Easy Draw Mini Board controller may offer various drawing modes or presets, allowing users to select predefined patterns, shapes, or designs for the plotter to execute. These modes streamline the plotting process by eliminating the need for manual input, making it easier for users to create intricate drawings or designs.

**5.3.7 Emergency Stop**

For safety purposes, the controller may include an emergency stop button or switch that immediately halts the plotter's operation in case of an unforeseen issue or hazard. This feature provides users with peace of mind and ensures quick intervention in emergency situations.

**5.3.8 Compatibility**

The Easy Draw Mini Board controller is designed to be compatible with a wide range of 2D plotters, offering seamless integration and interoperability with different models and brands. This ensures versatility and flexibility for users who may work with multiple plotter setups.



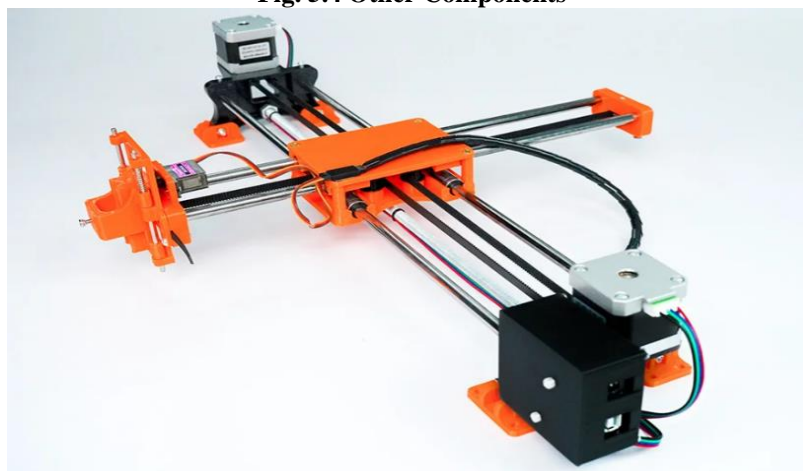
**Fig. 5.3 V3 Controller**

**5.3.9 Some Other Components**

The other basic parts are manufactured with the help of a 3D printer and they are all integrated together to get a good output.



**Fig. 5.4 Other Components**



**Fig. 5.5 Final Setup**

## APPLICATION

Easy Draw V3 is an extremely versatile machine, designed to serve a wide variety of everyday and specialized drawing and writing needs. You can use it for almost any task that might normally be carried out with a handheld pen. It allows you to use your computer to produce writing that appears to be handmade, complete with the unmistakable appearance of using a real pen (as opposed to an inkjet or laser printer) to address an envelope or sign one's name. And it does so with precision approaching that of a skilled artist, and-just as importantly using an arm that never gets tired.

## CONCLUSION

Even though more number of CAD/CAM software are available for building as well as production drawing, printing and plotting of plan, elevation and other views, the 2D sketcher can do different building drawings as required by the customers. This requires some modification in drawing can be obtained by the software we are using manually or by generating through Inscap software the proposed 2D sketcher gives instant priming or sketching of building drawing in an A4 sheet further the application of proposed 2D sketcher can also be extended in the field of printed circuit board (PCB) drawing and drilling, Electrical discharge machining (EDM), metal removal and fabrication, lettering and logo designs or engraving as well.

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