



# Design and Fabrication of X-Y Plotter Drawing Machine

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**Abstract**—This paper presents a new approach to design a machine which can use the image to make a 2D workspace drawing which helps artists to draw the images. The design of this X-Y plotter drawing machine comprises both the hardware and software. In this project, the images taken by our camera from the environment is converted into a G-code file from the JPG or PNG file format. The Inkscape software is making this work. Then the Universal G-code sender feeds the G-code to the computer. The machine has Arduino UNO microcontroller to make this feeding process. The CNC Shield V3 driver gives control to stepper motor (tool holder movement) and servo motor (tool up and down movement) through the separate motor drivers.

**Keywords**— Arduino UNO, CNC Shield V3, Stepper Motors, Servo Motor (SG90), Motor Drivers.

## I. INTRODUCTION

The modern technology has contributed to helping and developing human lives in every way. For the revolution of industry, the manufacturing of the many products has been developed by the modern technologies. These made the improvement in the following aspects of manufacturing, Accuracy, precision, Durability, Fault Reduction, etc. It gives the knowledge of making a Computerized control of manufacturing machine called CNC (Computer Numerical Control). This project explains the working of a CNC which works on two-dimensional Workspace based on X and Y-axes. This project includes two-dimensional data on a rectangular coordinate system that helps a wide range of applications such as Technical Drawing, Traditional Artworks and for Certificate Signing. From the hardware side of the project, it has two stepper motors for the X and Y-axes movement and a servo motor for the tool (writing pen or equipment) movement on the workspace. They are controlled by Separate drivers which differentiates the peak torque capability, cost, speed range of the motors. These drivers are controlled by the CNC Shield V3 which is provides the power necessary to the Arduino microcontroller for the control of drivers and motors. The Arduino UNO microcontroller takes control of the overall motions of the motors and according to the instructions from the G-code, Arduino sends instructions to the motor drivers to perform specific movements. A 12V Power Supply is given to CNC Shield. From the Software Side of the project, the software named Inkscape is used to convert the data collected into a G-code through the UGS (Universal G-code Sender). This data is an image file of the work diagram or a 2D CAD file in the format of JPG or PNG. The microcontroller is fed with the G-code and it sends the file to CNC Plotter Machine. It draws the diagram based on the Mathematical calculations that already fed to the plotter.



## II. PROPOSED METHODOLOGY

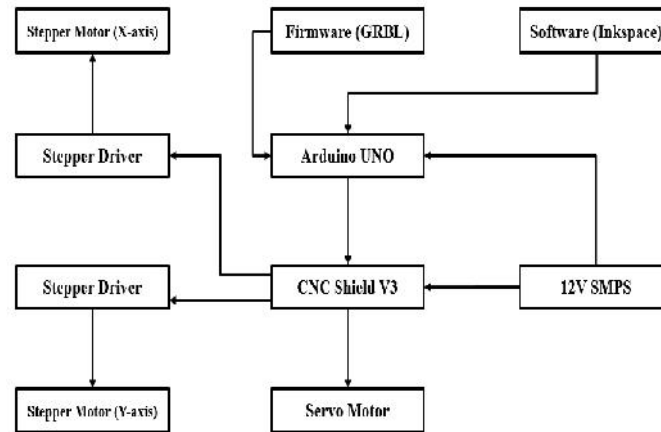
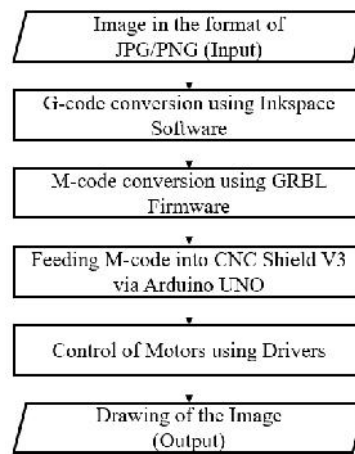


Figure-1: Block Diagram

## III. PROCESS

The block diagram of the project is shown in Figure-1. Arduino UNO microcontroller is the main component in this project. It controls the basic operations which are motor control and the executing G-code commands. The image of the design has uploaded into the Inkspace software and the necessary pre-set for the machine to be modified. Inkscape will generate the path and G-code for that image. Then G-code is sent into Arduino UNO microcontroller through communication port. GRBL Firmware have already uploaded onto the Arduino microcontroller which converts the G-code into the M-code that will be sent into the CNC shield. CNC shield consists of two stepper motor drivers (A4988) which controls the movements of the X and Y-axis respectively. CNC shield also houses the servo motor limit switch which controls the Servo Motor for the tool movement. 12V SMPS will Give the power supply to the Whole Setup.

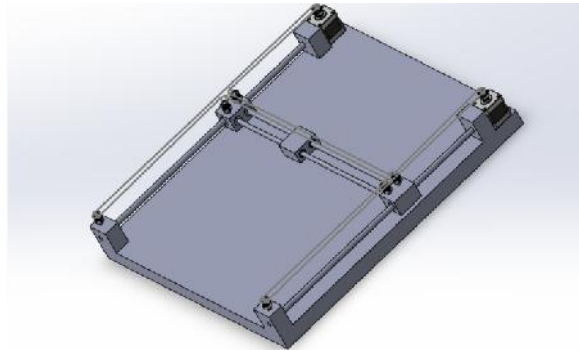
Figure-2 shows the flowchart of the process in the project.



**Figure-2: Process Flowchart**

#### IV. DESIGN

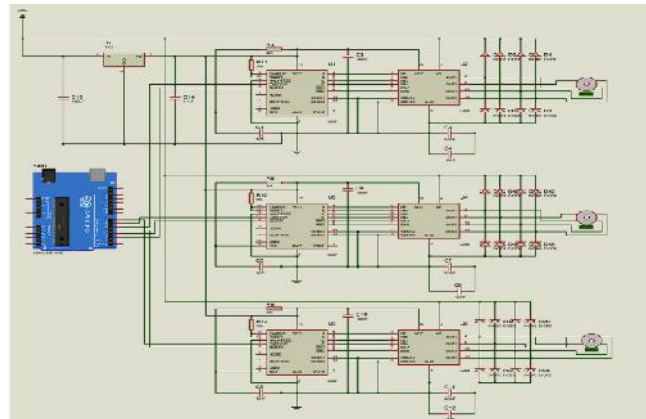
The CAD (Computer Aided Designing) and CAE (Computer Aided Engineering) software named SolidWorks, created by Dassault Systems is used to Design the 3D Model.



**Figure-3: 3D CAD Model**

#### V. CIRCUIT DIAGRAM

The electronic schematic design software named Proteus Professional is used to design the Circuit.

**Figure-4: Circuit Diagram**

## VI. CONCLUSION

As per the Design, The XY Plotter will draw the Image that we have given on any plane Surface according to the tool. The H-shaped design will give more stability and dampening effect than other designs. Also, its simpler controls will give the ability to accessed by anyone. It is Also portable and less size which occupy Less space. It is cheaper and have more compactable parts that can be replaced.

## VII. FUTURE SCOPE

As part of the future scope, it can be used in wall designing with some added components that suitable for the improvement. The advanced version of this project will contain the tool changer that can change the tool while drawing. These additional improvements will give the artwork more depth and detailed.

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