AUTOMATIC PCB DESIGNER BASED ON CNC SYSTEM

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Abstract - CNC Machines are Computerized Numerical Control Machines which are used to plot anything to the design program fed into their controller unit. CNC machines have stepper motors to plot the design given G-code as per the fed program. The proposed system uses a robotic arm which helps in plotting the circuit on to the copper board. The robotic arm plots the layout to the board as per the directions given by the controller. There are many techniques existing in the PCB printing process. Some of them are screen printing, laser printing, manual printing etc. All these, methods have some of the following demerits such as high cost of production, high requirement of man power, highly time consuming. All these disadvantages can be overcome with the help of our proposed PCB printer. The proposed system uses a robotic arm which helps in plotting the circuit on to the copper board. The proposed system also makes retracing of the circuit from the PCB possible. This is made possible by moving the robotic arm above the circuit and tracking each point in the circuit.

Key Words: Computerized Numerical Control, Printed circuit board, Plotter, G-code.

1. INTRODUCTION

Project proposed here uses an idea of CNC bit plotter using Control board. The idea behind this project is to make a CNC machine which can be used for etching the PCB Board. It uses three Stepper motors is linear actuators on each axis X, Y & Z. While etching, the PCB synchronization of this entire three axis i.e. stepper motors, is most challenging task. At present the data to draw to given programmatically i.e. hard coded in program in binary format. A bit touches the surface & prints the pixel for logic 1 and lifts up in air for logic 0 & actuator changes its position for next commands execution.

G codes is an elementary Function. G codes is pre-defining Function Associated with the movement on machine axes. In CNC Printer Machine only G codes are used. G codes are giving the Direction to move the driller in X, Y, Z directions. The aim of over is to make a CNC printer machine which is capable to draw difficult design in paper or surface of metal, to cut it with a great accuracy. We have used 3 stepper motors with lead screw in Cartesian coordinate X, Y, Z directions. Stepper motor is a convert digital pulse into lead screw rotations. Stepper drivers are used to give command on the system. The main aim is to fabricate a CNC printer Machine to draw an object with using G codes. We also work on reduced cost of the project and increase Reliability and Flexibility. This will be used for soft material cutting or mining, laser cutting machine tool is also worked on this setup.

In our work the CNC plotter is designed for printing any dimensional instructed data on a rectangular co-ordinate system from G-Code. The 3D Printer mechanism is totally control by Control board, CNC shield and three motor drivers. G-code control the motors exactly where to go in X, Y, Z direction. X axis stepper motor with lead screw control the X, Y co-ordinate and Z axis motor controlled the depth means the drill of the printer bit. The CNC printer can be used to make printed circuit board (PCB) for printing circuit diagram by the instruction from G-code.

2. Methodology

PCBs direct current is around their surface through a network of copper pathways. The complex system of a copper routes determines the unique role of each piece of printed circuit board. The methods are PCB designing - Component Selection and Testing - Hardware Implementation - Designing of PCB Layout - From File to Film- Printing the Inner layers- Removing the Unwanted Copper- Layer Alignment and Optical Inspection- Drill and Milling- Outer Layer Imaging- Final Etching- Solder Mask Application- Silkscreen- Electrical Test- Profiling and V-Scoring.
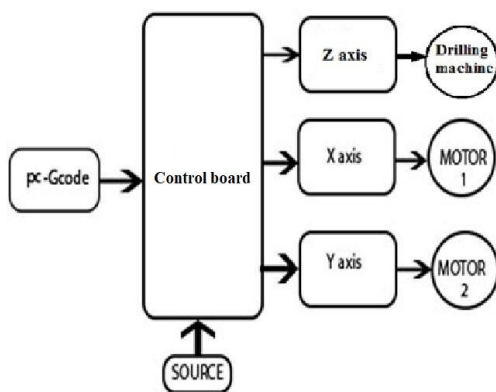
3. BLOCK DIAGRAM

Fig.1 Block Diagram of CNC mini Plotter Three axis control machine
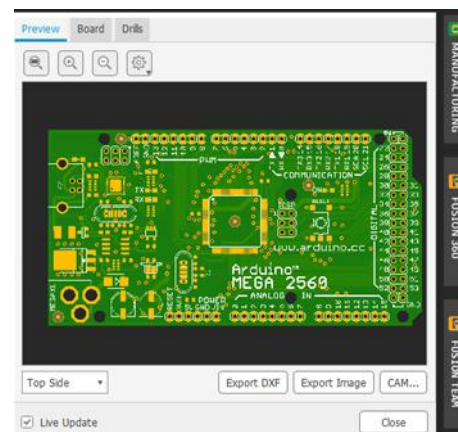
5. WORKING:

CNC milling is a specific form of the computer numerical controlled (CNC) machining. However, the cutter in a milling machine is able to movement along multiple axes, and can create a variety of shapes, slots and holes. In addition, the work-piece is often moved across the milling tool in a different directions, unlike the single axis motion of a drill.

Typically they are grouped by the number of axes on which they operate, which is labeled with various letters. X and Y designate horizontal movement of the workpiece and Z represents vertical axes, or up-and-down direction, movement. These devices are extremely useful because they are able to produce the shapes that would be nearly impossible using manual tooling methods.

Drilling is a cutting method it use a drill bit cut to a hole of the circular cross section is a solid materials. The drill bit is always usually a rotary cutting tool, often multi point. The drill bit is pressed against the work piece and rotated at rates from hundreds to thousands times of revolutions per minute. This forces the cutting edge against is the work-piece, cutting off chips from the hole as it is drilled.
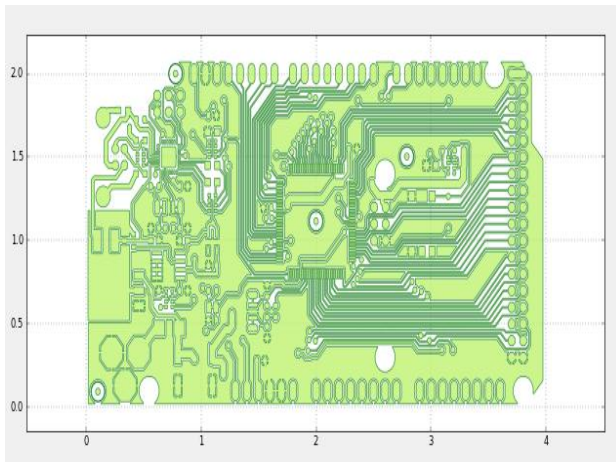
SOFTWARE IMPLEMENTATION:

EAGLE (EDA):

EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor

FLATCAM:

Lets our take our designs to a CNC router. Open Gerber file, Excellon or G-code, edit it or create from scatch, and output G-Code. The Isolation routing is a one of many tasks that FLATCAM is perfect for. It is open source, written the program in Python and runs smoothly on most platforms.

Viewer:

Visualize Gerbers, Drill files, and G-Code. Know exactly how our machine is going to make our PCB.
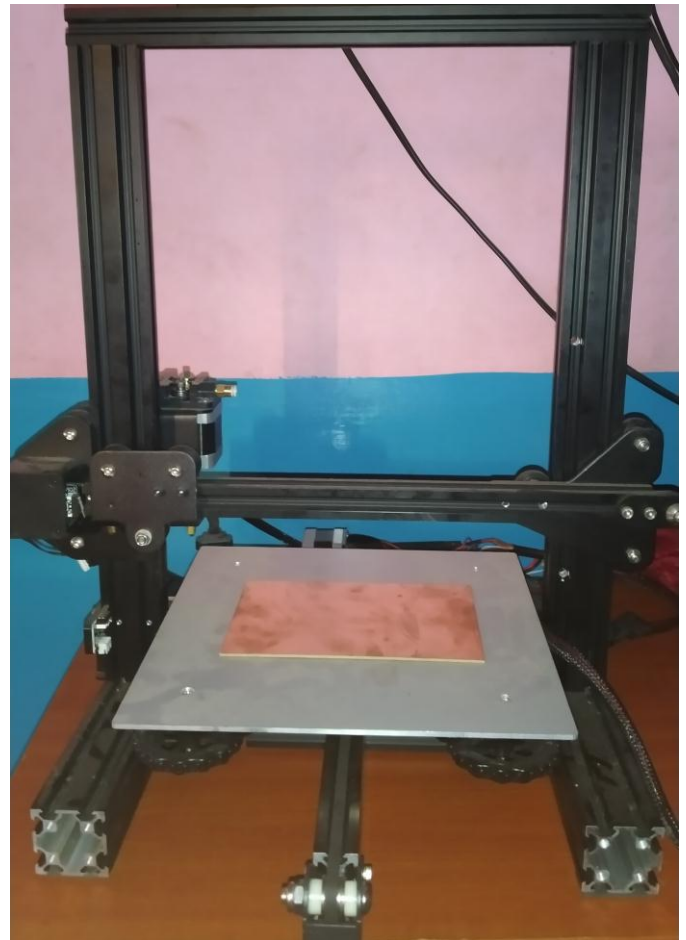
Double sided:

Make a double-sided PCBs quickly with a specialized built in the tool that allows our to invert our layers and create alignment guides.

Source file:

- **G-Code:** CNC machine instructions for cutting and drilling.
- **SVG**: Scalable Vector Graphics. A common resolution-independent graphics format.

EXPRIMETNAL SETUP:

Thus, by using Control board and PCB making EAGLE software we are designing PCB from layout milling and drilling according to on PCB layout.

APPLICATIONS:

- CNC used for cutting various hard materials such as wood, aluminum, steel, plastics.
- The CNC machine can print objects with 2D and 3D.
- CNC include both machine tools are as well as non-machine tool areas. In the machine tool category.
- CNC machine is widely used for lathe, drill press, milling machine, grinding unit, laser, cutting unit, sheet-metal press working machine, tube bending machine etc.
- 3D Printing for Non-planar Electronics.
- 3D Printing for Multi-layer PCBs.

CONCLUSION:

In this paper we have used concept of low cost PCB printer machine, which is easily control with computer and

suddenly stop and paused by click action on computer. By using this we have make Difficult and Complex Design in paper. This is small machine which is easily Transportable and Assembled everywhere on Requirement of it. Bed Size of this machine is 220X220X250mm. Stepper Motor will be run on in this criteria of bed size. If we have increase the size or length of lead screw, it will be free to make big size of design in paper. We have used G codes to giving command. G-codes are language to give the command to the machines parts are move right, left or up and down. On the successful work of this machine we have some change on it and make it commercial used and applying tools for cutting, grinding of soft material etc. In PCB process such as drilling, milling and etching.

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