



PCB DESIGN PLOTTER USING CNC SHIELD AND ARDUINO

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ABSTRACT:

The word "CNC" refers to a broad category of devices that includes drills, wood cutters, 3D printers, and milling machines. Essentially, "CNC" stands for computerised numerical controlled, and actual movement of the machine is controlled by computer-generated instructions such as coordinate position. We give here an idea of CNC bit plotter using ARDUINO based on CNC technology, the most significant revolution in the field of digital electronics and microcontrollers. The goal of this paper is to build a small CNC machine that can draw graphics or photos on any surface, such as paper. It employs three stepper motors as linear actuators on each of the three axes (X, Y, and Z). The most difficult aspect during printing is the appropriate synchronisation of this full three axis, i.e. stepper motors. At the moment, the data to draw is provided programmatically, i.e. hardcoded in binary format in the software. For logic 1, a bit touches the surface and prints the pixel; for logic 0, a bit rises up in the air and the actuator changes position for the next command to be executed. As a future plan, it will be able to access the G-Code directly from supporting software, such as in scale. The plotter presented here is a one-dimensional (1D) plotter. The current research study describes the automatic design of a PCB utilising CNC and an Arduino mega.

Keywords: CNC, PCB, Arduino, Micro-controller, Plotter.

1 Introduction:

Electronic device output has expanded dramatically in recent years, including mobile phones, tablets, notebooks, and other devices. This technological revolution has occurred as a result of the widespread adoption of PCBs in all circuits. The flow of electrical current through a desired channel from one place to another is the basis for the operation of an electronic circuit. The conductive marker on the 2D plotter is used to design this path[1]. The operation of a 2D plotter is similar to that of a CNC machine or 3D printing, in which an object is, moved in the x and y directions using two stepper motors in accordance with the input image. Express PCB or Autodesk eagle programme is used to create the input picture. With the use of Benbox software, the image is turned into g-code, a numerical form of code that instructs the plotter to move the object in co-ordinates form as per the pattern. According to our programme, the object utilized here is a conductive marker [2, 3].

This technology replaces the use of dangerous chemical procedures with a computerized mechanic system, removing the need for human involvement with such chemicals.

2 Experimental Work:

Methodology:

The hardware and software implementation of a CNC to sketch PCB layout and drill holes is examined in this study. A computer, a driving stepper motor, and a software programme make up the system, which includes an electro-mechanical setup that can move in the X, Y, and Z directions. The drive circuit is designed to both operate the mechanical equipment and connect with the computer via software. The software programme is designed to govern the machine's entire operation. We designed a PCB layout to show that the machine can produce a trace line on a single layer PCB board and drill holes on both ends of the trace line in this early work. A flat layer on the X-axis of the mechanical setup is where the PCB is placed for further processing. A drill that can travel along the Y and Z axes is located above the X-axis. Through the Z-axis, the drill can also move up and down for a predetermined distance. A milling and drilling bit is attached to the bottom of the drill. This bit creates both the arrangement and the holes. On a single layer PCB, create a trace line. The start coordinates of a trace line are then sent to the arduino uno board. The drill is moved to the coordinate point when the arduino uno board

receives this signal. The drill is in the up position during this action. When the drill receives the desired spot, the PCB machine lowers the drill, begins drilling, and continues to move according to the task given from the computer. The coordinates must correspond to the borders of the trace line to be drawn. As a result, when the procedure is finished, the trace line is separated from the remaining copper on the PCB. To drill a hole on the same PCB, we let the machine finish tracing first and then readjust. Following that, we specify coordinates and direct the drill to those locations, where it will drill one at a time.

Block diagram:

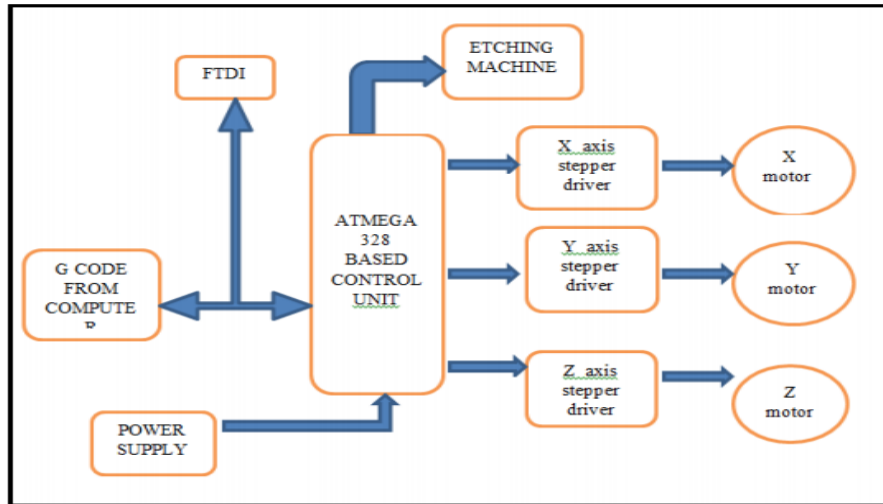


Figure 1:Block diagram of PCB design plotter

Circuit diagram:

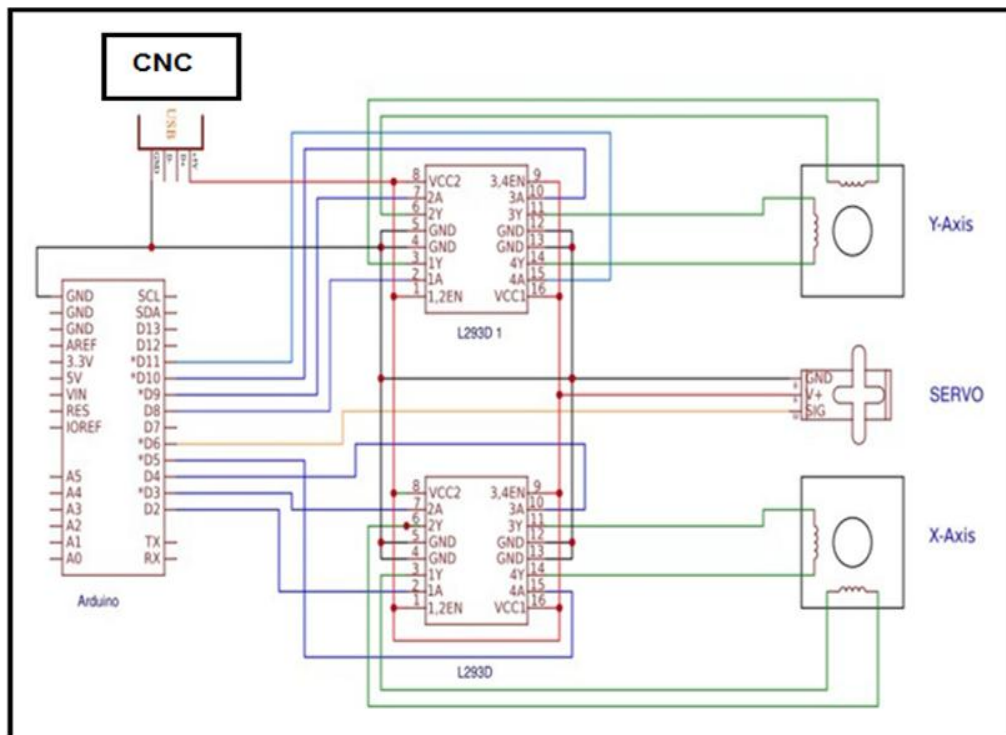


Figure 2: Circuit diagram of PCB design plotter

Working of circuit:

The PCB is inserted in this system, and then it is automatically drilled using path planning. The PC gives the X, Y, and Z coordinates, and the PC

Programme reads the file generated by the PCB design software. Another approach employs a basic 8051 microcontroller and a drilling driver created by relays, which makes the system big and insufficiently current to drive the motor precisely. Another method is to programme a microcontroller in C. To control the drill, the system consists of three stepper motors and one AC motor. As a result, the system becomes intricate and unstable.

The path planning method is not used in the proposed project. Furthermore, the automatic PCB drilling machine has a route planning algorithm capable of calculating a precise drill bit traversing path. The path planning algorithm maximizes the utilization of motors and other mechanical paths while lowering the total time required to cross all drill holes. The developed programme in this project determines the location of the drill hole. The past and current coordinates are then calculated, and the coordinate information is sent to the Microcontroller unit via USB cable. To complete the drilling of the PCB, stepper motors move based on coordinate information.

3 Software Section:

Algorithm:

- Step 1: Gets inputs of PCB diagram (gerber files)
- Step 2: Convert gerber files to G-code.
- Step 3: Changes input into machine language of coordinates that is sent to AtMega328P.
- Step 4: Serial communication between PC and ATmega.
- Step 5: Coordination of servo motor and driver control position stepper motor.
- Step 6: Checking current that is measured at servo motor.
- Step 7: Checking PCB drawing process
- Step 8: Setting initial parameter values by setting initial position values of two stepper motors.
- Step 9: Drawing on the PCB board (automatic modes, steps per revolution, pause & stop).

Flowchart:Flowchart of G code for the system reveals in Figure 3.

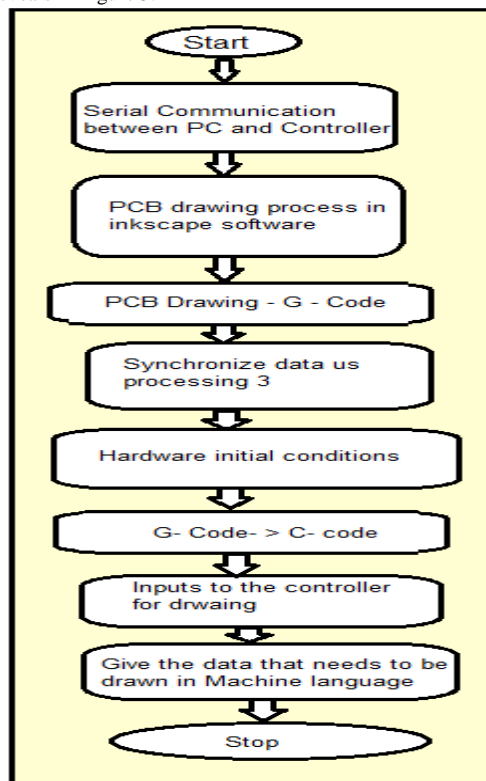


Figure 3: Flowchart of G code

Advantages:

- Easily repairable.
- Lesser chances of short circuit.
- Saving time and lower cost
- Little to no electronic noise.

Disadvantages:

- As the copper tracks are very thin they can able to carry less current hence a PCB cannot be used for heavy currents because in that case the strips

will be heated up and cause problems.

- Soldering needs precautions on the risk of strips being over heated and destroyed are always there.

4 Applications:

- The CNC machine can print objects with 2D and 3D.
- CNC include both for machine tool as well as non-machine tool areas. In the machine tool category
- CNC is widely used for lathe, drill press, milling machine, grinding unit, laser, sheet-metal press working machine, tube bending machine etc.
- Highly automated machine tools such as turning centre and machining centre which change the cutting tools automatically under CNC control have been developed. In the non-machine tool category.

5 Conclusion:

With the help of this CNC and Arduino megautomatic design of a PCB is possible. We created G-code of PCB design using Inkscape software and simulated it using CAMotics software. Automatic mini CNC machine is designed and developed for PCB drawing using Arduino for low cost and for better accuracy.

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