

Computer Numeric Control Based Cutting Tool

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Abstract- The process of cutting raw materials is one of the most basic processes in a manufacturing industry. The cutting tools used earlier were capable of shaping metals more accurately than it was possible by hand they allowed manufacturers to consistently produce parts that were nearly identical in shape, size and form. The requirement of higher accuracy accompanied by tremendous development in technology paved way to Computer Numeric Control (CNC) based machines. Since then, CNC based cutting equipments have been long used in manufacturing industries for processing and cutting of raw materials. Computer Numerical Control means a computer converts the design produced by computer design software, into numbers. The numbers can be considered to be coordinates of a graph and they control the movement of cutter. In this way the computer controls the cutting and shaping of the material.

CNC machines contribute to achieve machining automation besides achieving high productivity and high accuracy in machining operations. The CNC machines provide flexibility to manufacturing process since they are capable of producing not just basic shapes but also complex shapes.

Our project aims at designing basic CNC cutting equipment. We intend to develop a cutting tool that would be capable of cutting the material into 2 dimensions, with basic shapes and limited dimensions. Here the cutter is assumed to be a pen. The project will use a keypad for feeding the basic design to the device. The operation of CNC machine will be emulated by a pen that resembles a cutting tool, the pen traces a trajectory on the piece of paper that resembles the actual material itself.

I. INTRODUCTION

CNC means a computer converts the design into numbers. The numbers can be considered to be the coordinates of a graph and they control the movement of the cutter. In this way the computer controls the cutting and shaping of the material. The device will be operate in a similar way as a CNC machine. The X-Y coordinates of desired shape to be cut out of the material can be given through keypad . The input shape will act as a trajectory for the movement of over the paper .

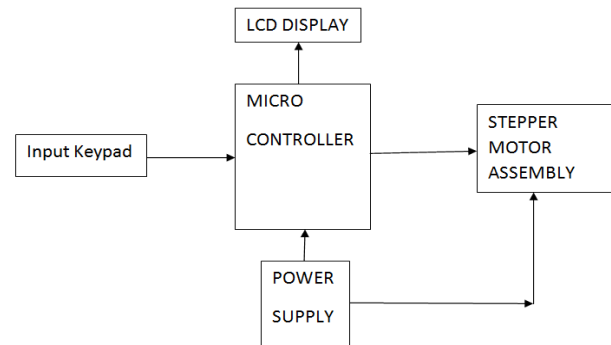


Fig.1 Block diagram of CNC cutting tool

The x- y coordinates will be used in an algorithm stored in a microcontroller. The microcontroller in turn commands the movement of stepper motors. The motion of pen over the paper will be in the form of continuous lines joining the points on the trajectory. The tool will draw various rectangular shapes on paper.

II. RESEARCH ELABORATIONS

The process of cutting raw materials is one of the most basic processes in a manufacturing industry. The cutting tools used earlier were capable of shaping metals more accurately than it was possible by hand they allowed manufacturers to consistently produce parts that were nearly identical in shape, size and form. The requirement of higher accuracy accompanied by tremendous development in technology paved way to Computer Numerical Control (CNC) based machines.

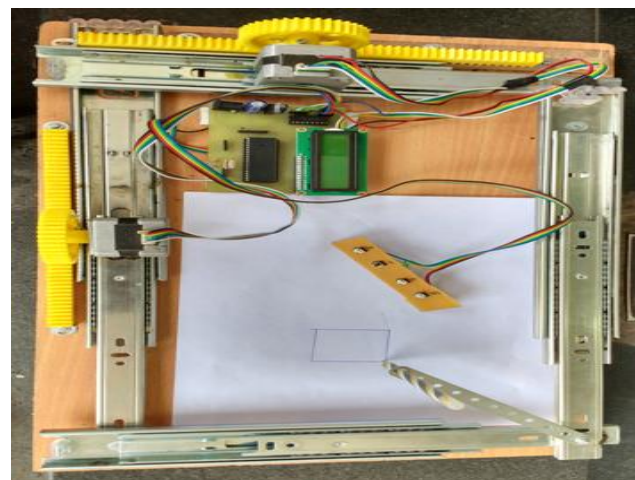


Fig.2 Hardware overview

Since then, CNC based cutting equipments have been long used in manufacturing industries for processing and cutting of raw materials. In Computer Numerical Control a computer converts the input design into numbers. The numbers can be considered to be coordinates of a graph and they control the movement of cutter. In this way the computer controls the cutting and shaping of the material.

CNC machines contribute to achieve machining automation besides achieving high productivity and high accuracy in machining operations. The CNC machines provide flexibility to manufacturing process since they are capable of producing not just basic shapes but also complex shapes.

III. WORKING PRINCIPLE

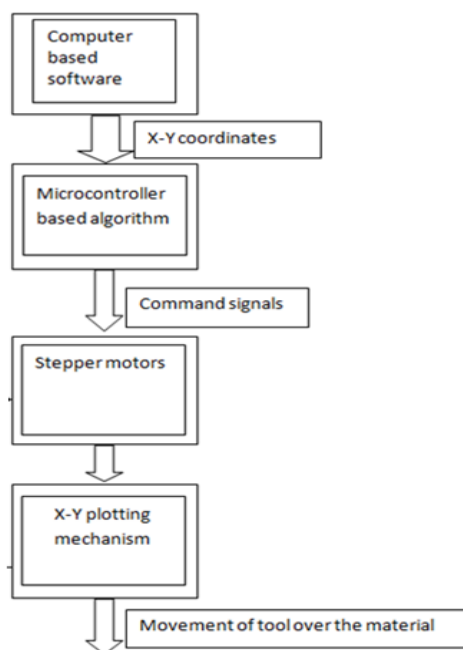


Fig.3 Working principle of CNC tool

The project aims at implementing CNC based machines. The CNC based cutting tool consist of keypad, AC to DC adapter, PIC microcontroller (5V dc), 16 x 2 LCD display, stepper motor assembly (12V dc), gear mechanism, drawer mechanism.

When 230V main power supply given to adapter it rectifies into 12 volt dc. This 12 v dc is given to stepper motor assembly and also this 12v dc is converted to 5v dc through 7805 IC regulator fed to microcontroller.

When power is switched on the LCD displays “CNC based cutting tool” then we have to give input x and y coordinates through keypad which is displayed on LCD display and by entering the run button the microcontroller gives signals to stepper motors. First it drives X axis

motor(clockwise) then Y(clockwise) again X(anticlockwise) and then Y(anticlockwise). In this way it completes the loop and draws the rectangle accordingly. This CNC based cutting tool works in two dimensions.

We have arranged a pen holding assembly in such a way that it will move on paper with the stepper motor rotations. When pen moves it draws the reference line on paper. This line indicates the shapes to be cut. Instead of cutter we have used pen. We have programmed in such a way that the motor will move 1 unit for 1.8 degree step angle.

For different rectangular shapes we have to follow the same procedure by changing X-Y co-ordinate inputs.

IV. RESULTS OF FINDING

The results taken during working condition

- There are four buttons on keypad-set, increment, decrement and enter. Initially LCD displays “CNC based cutting tool”.
- Pressing set button first gave X- axis coordinate by increment and decrement button then save them by enter button. Similar procedure for Y- axis coordinates. Then to run press increment button.
- We gave 1 unit for x-axis and 1 unit for y-axis, the pen moves with motors along two axis and draws a small rectangle then motors stop.
- After that we gave 10 units to both axis and run the tool, it then draws bigger rectangle than previous.

V. CONCLUSION AND FUTURE SCOPE

- By CNC based cutting tool cutting is made automatic and thus can reduce the labour requirement in automation field. Due to precision and accuracy of the CNC based cutting tool it made operating simple. Thus the accuracy increased.CNC machines are easy to handle, the work becomes easier
- There is always remains an infinite scope of improvement to instrument designs. Its only the time and financial constraints that impose a limit on the development. Following are the few enhancement that may add further value to the instruments.
- By using different controller programming different geometrical shapes can be obtained
- By making instrument three axis [X-Y-Z] complex shape cutting is possible.
- Instead of using pen cutters like water jet, laser, drills can be used

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