Overview of 2-D Cnc Router Machine

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Abstract- As this is the era of portable machine, less expensive machine and user-friendly equipment. As it is not possible to take the Computer Numerical Control (CNC) machine every ware because of its size and weight. Many of people don't know how to use Computer Numerical Control machine and design software are also not user-friendly which create more problem for laymen. In this paper, the overview including advantage and limitation are discussed. CNC's had made revolutionary changes within the manufacturing sector. In earlier days achieving productivity up to the desired level was not possible due to lots of drawbacks like the complication of shapes and sizes, lack of skills in labors, lots of wastages and scraps due to unexpected mistakes and low-quality levels and accuracy. By using portable CNC router this all drawbacks can be overcome and this is the contribution of this paper to show the performance of CNC. The 2-D profile is considered for cutting by using 2-D CNC router machine in the aluminum material. The profile is such that which is difficult to cut by conventional machining processes. After selecting the profile, programming is done and by using program simulation is carried out. After simulation, the profile achieved from it is matched with the decided profile and program. Finally, the profile was cut by using 2D CNC router machine which gives smooth and finishes surface with the high rate of accuracy with less machining time. Hence it increases the productivity it is economical as compared to the conventional machining process.

Keywords- 2-D computer Numerical Control, G-code, simulation, profile cutting.

I. INTRODUCTION

CNC means Computer Numerical Control. This means a computer converts the design into the program which the computer uses to control the cutting and shaping of the material In Industry it is not efficient or profitable to make everyday products by hand. On a CNC machine, it is Possible to make hundreds or even thousands of the identical items in an optimum way. First, a design is drawn using design software, and then it is processed by the computer and manufactured using the CNC machine. This is a small portable CNC router machine and can be used to machine woods, plastics, and soft metals like aluminum. In industry, CNC machines can be extremely large. A numerical control system in which the data handling, control sequences, and response to input is determined by an on-board computer system at the machine tool. The first NC machines were built in the 1950s by Prof. John T. Parson. CNC machine came into existence after the evolution of computer around 1980.Modern CNC Machine is improving further as the technology is changing with a variety of functions according to applications.

As the programming make the machines, reliable and profitable in their tasks, for major organizations and even for the single buyer. Parts can be worked out and can be observed as the perfect required parts after their machining at CNC cutting, drilling, reaming, milling and Lathe machines. Mostly the CNC machines are made just for single use because of the apparatuses are unable to get change the tool at the head. Depending upon the fact, that how the design is precise, these machines run with slightly higher speeds to make the surface more finish. Because of very high cost, these machines have become difficult to purchase for the local workshops from markets. In the same way, these can't reach to the small growing units of the market too. According to the survey, it has been seen that there are many conventional machines but all of these setups are purely conventional, not CNC, and are imported from abroad. Hence small scale fabricator can't bear its cost of import.

II. RESEARCH METHODOLOGY

Very firstly the CNC machine and its various parameters are studied. Then some basic calculation for deciding the required component is carried out. Calculation includes the calculations for required RPM (revolution per minute) for engraving material and then the stepper motor calculation for deciding the specific stepper motor and design of beam on which the spindle is going to be mounted for resisting the bending movement of the beam and free movement of the spindle.

After completion of component calculation and deciding the specific component we start making the base frame. Then the component is mounted on the frame. After mounting component interfacing of GRBL shield and microcontroller with the help of software is carried out. Then the G-code is formed according to the required design. G-code is sent to Arduino by USB connection. Then the code from

Arduino is taken up by the CNC shield to which stepper motor driver is attached. Stepper motor drivers convert the code according to the instruction and led the stepper motor move. The instruction for spindle like speed, ONN and OFF is provided in G-code. If someone is using coolant then the instruction for coolant is also provided in G-code like coolant ON and coolant OFF.

III. MECHANICAL AND ELECTRONIC COMPONENT OF MACHINE

The mechanical component which is used is ball bearing, metal rods, nut and bolt, multiplex board, lead screw, spindle, metal bars for the frame, aluminum beam. This all the components are connected to each other by nut and bolt as shown in the figure. This all the component are connected to each other as per predefined design.

A. SPECIFICATION OF MACHINE

Controller   : Arduino Uno microcontroller.
Spindle   : electric spindle.
Stepper motor   : NEMA 23.
Supply   : 24 V / 50 – 60 Hz.
Dimension   : 700 x 700 x 180 (mm).
Function   : cutting, engraving, marking, drilling.
Software   : Universal G-code sender.
Driving system   : lead screw and belt derive.
GRBL   : Version 0.9
Interface   : USB.
Material   : wood, soft metal, plastic.
The number of stepper motor: 4

IV. WORKING

This machine is very easy to use. As it is 2D router machine, it can be used as carving machine by which the different patterns can be drawn on the surface of the objects. For example, in order to make oil flow paths in the engine head, block, etc this machine could be used just by applying the higher version of spindle and tool on it. In order to start the work on it, it was necessary to make the patterns (whichever pattern is required). This pattern can be made on solid-works, auto-cad, Ansys and Pro-Engineer software. It could be saved in a format of .dxf format. After making the pattern on any software and saving it in .dxf format, this file could be imported into software, which was G-CODE program. Here the file was used to generate the codes for the pattern made by Ansys, AutoCAD, lotus shark, creo etc. From this software, the file was needed to be saved as the .dxt format. Now,

finally, this file containing codes regarding the pattern designed was imported into simulation software.

Controller installed on the machine used this file instructed the machine to operate according to the codes given in the file of .dxt format. The work piece can be any plate, object, or bar on which the drill bit has to move on it to make the same pattern which was made on the software in its initial stages. Guide, framing and mechanical drive systems were three mechanical subsystems in this machine. Lead screws were observed as the efficient screws which were reducing the friction losses. Due to the decrease in friction, energy was being saved by this machine too. Actually, there were different structures and materials for the frame of the machine and there were also different types of the parts available in the market too but synchronization is difficult. It was better to use the self-manufactured parts as the design was already made on AutoCAD software. Because of rigidity requirements, wood, harden metal material was used for the structure of the machine.

DESIGN OF 2-D CNC ROUTER MACHINE
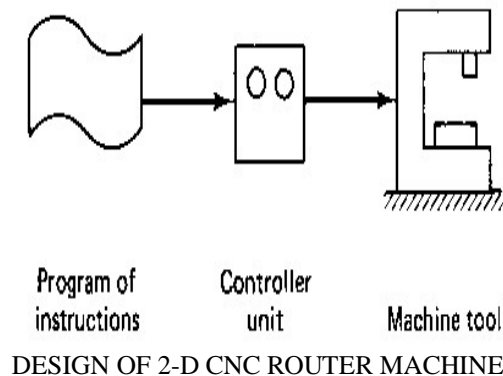
V. ADVANTAGE

- CNC machine are made for continuous manufacturing.
- Accuracy and precision of CNC is very high.
- Because of modern software which is use for simulation there is no need of trial and error method.
- It need less time than conventional machining process.
- CNC is capable of making number of identical parts.
- By changing tool different application can be performed.
- Ones the operation is setup then there is no need to supervise.
- It requires less effort than conventional machining process.
- Less human error found and hence reduces scrap.
- It is very safe.

VI. DISADVANTAGES

- It reduces the job opportunities which lead to unemployment.

- Many people do not use the CNC as it includes some engineering calculation.
- Requires regular maintenances.
- If machine is use for mass production and any error occurs at any moment then whole consignment will be wastage.

VII. CONCLUSION

The aim is to make portable and low-cost CNC machine by using the alternate components which are easily available at the market at low cost. Is tried to make the machine user-friendly or which can be used by layman by taking some minimal effort ones G-code is prepared. The machine is capable of working on various materials includes plastic, wood, fiber sheets, soft metals like aluminum etc.

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[7] Design and Implementation of 3 Axis CNC Router for Computer Aided Manufacturing Courses

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