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Methodology for Selecting Components While Fabricating CNC Milling Machine for Small Range Industry

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Abstract— *The rapid increase in technology has significantly increased the use and utilization of CNC systems in the industry, but at a considerable cost. The idea of manufacturing a numerically controlled milling machine has emerged as a solution to reduce the cost and complexity of numerically controlled systems. This article discusses the development of low-cost CNC milling components capable of simultaneous three-axis interpolation. Lower cost is achieved by using the features of a standard PC interface with a microcontroller-based CNC system in an Arduino-based integrated system. The system also has a stand-alone G-code analyzer, which is then interpreted on a microcontroller with USB. The system uses improved procedures to reduce IT costs associated with managing a 3-axis CNC machine, while avoiding any loss of overall system performance.*

Keywords— *Computer Numerically Controlled, CNC Milling Machine.*

I. INTRODUCTION

CNC milling machines cut objects into durable materials and are widely used in modern production. They allow the rapid creation of prototypes in the workshop and increase the speed and efficiency of production lines. In modern CNC systems, the design of complex components is highly automated through computer-aided design (CAD) and computer-assisted production (CAM) programs. The programs create a computer file, which is interpreted to extract the commands necessary to operate a particular machine through a post-processor and then loaded into CNC machines for production. Since a particular component may require the use of different tools (drills, saws, etc.), modern machines often combine different tools in a "cell". In other installations, several machines are used with an external controller and robotic people or operators who move the component from one machine to another. In any case, the sequence of steps needed to make a part is highly automated and creates a part that exactly matches the original CAD system design. With the continuous development of technology and the economy, new industrial needs are increasingly required, such as high precision, quality, high productivity and low production costs. Most of these requirements, including dimensional accuracy, finite product tolerance and performance, can be met with the best machines. With the help of CNC technology, machines are not limited to human capabilities and are able to produce high-precision products up to the Nano scale much faster. The traditional philosophy of machine design: versatility and high precision. However, with the sharp increase in industrial varieties and the increasing demand for miniature products, these Special machines are not efficient either in terms of time or in terms of costs for machines, for the manufacture of products with particular dimensions and precision requirements. The use of small machines for the production of small objects has several advantages. With a smaller machine size, the space is saved. Even the energy needed to make the machine work decreases. Less materials and components are needed to manufacture the machine, which significantly reduces costs. The weight of the mobile element is also reduced. Therefore, during operation, vibration and noise, as well as environmental pollution, are substantially reduced. When a machine becomes denser and lighter, it becomes more portable. The layout of the production hall can be more flexible. Productivity and production speed also increased due to possible faster work.

II. LITERATURE REVIEW

Considering the limitations of commercial numerical controlled vehicles with large-scale use in educational environments, several authors learned to develop such machines in small scale and cheap prices. For example, Pablo and Srinivas [4] created and implemented a three-axis CNC machine that uses 8-bit microcontrollers. Development is done. The Net Platform is using the C # programming language for Windows XP computers, but motors have limited power. Andrei and Nae [5], [6] developed a simple commercial CNC router (624x824 mm desktop) with Mach3 software on the computer, but it needed a parallel port. Pahole et al. Designed, evaluated and evaluated by the low cost of numerically controlled cars for modeled and educational purposes. [7]. Work size is 180x140x250 mm. The stable speed and positioning accuracy of the device is measured by experimental and controllable software from Mach3-to-computer with parallel ports. Sheering da Rocha et al. [8] the prototype CNC machine was presented with the PC's laboratory platform, which has the advantage of using the advantages of using visual software. The computer is connected to a serial port with low-cost micro contractors. CNC machines are designed and based on the use of low power engines and the use of moving motors in open loops mode. [9] The reviewed results will be discussed in an open CNC system using Windows PC using four axis movement

controllers. Wang et al. [10] has developed a real-time CNC system via Ethernet connectivity with the Windows computer's Windows NT operating system, the operating system aspect of the operating system may not be present for the buffer. Packages were sent. Because there is no guarantee that the Windows operating system offers real-time performance, it uses CNT System Prototype controller-oriented Linux [11].

III. Outcome Of Literature

An important new development in the field of information technology is cheap open hardware, such as the Arduino microcontroller platform and the presence of one Raspberry PI disc. One of the advantages of open source is the availability of software on the website; therefore, prototypes and development have continued to decline dramatically. In addition, cheap interfaces, sensors and accessories such as Arduino headlamps with clear instructions, examples, and the appropriate program code are also available on the Internet. CAD / CAM / CNC software provides several useful open source software, but they are not as versatile or powerful as they are commercial versions. However, in order to develop cheaper education models for CNC machines, such tools can be quite adequate for driving the vehicle. Therefore, the design and manufacture of CNC milling machine (based on Arduino based management) is presented.

IV. Objective

1) Most milling machines are expensive and difficult to use, making them unavailable for small businesses. High initial value and skilled workforce digitally controlled vehicles that are unsuitable for small and medium sized contractors. CAD / CAM and Manufacturing Technology.
2) In many Indian engineering facilities, laboratories are initially equipped with a large number of cost-effective controlled commercial techniques that exceed the educational needs of undergraduate students. They will have expensive consulting contracts and will spend a lot of time in case of trauma. Many of these arguments are welcomed by polytechnic colleges in India, which provide considerable support and are available for digitally controlled laboratory facilities. Idea of learning.
3) The idea does not have much CNC milling design and collection of the small and medium CNC machine industry. Work to work easily. Easy to use interface. Flexible. Low energy consumption. Design Clear design, easy to follow. Complete guide to construction and use. A low cost for educational purposes should be available. It will be easy to maintain.

V. Proposed Methodology

This system is divided into three modes. Figure 1. The mechanical system receives the necessary control signals in the electronic system and the motor operates. The electronic system receives orders or orders for software and creates orders for mechanical systems.

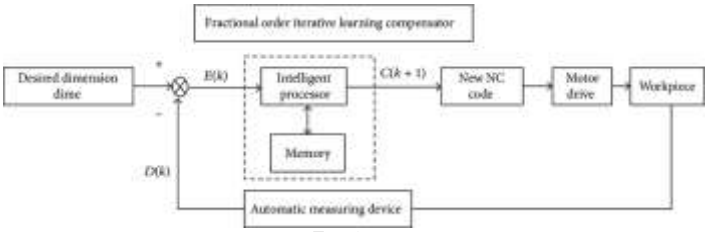

Fig. 1.

Mechanical system is installed so that 3 axis movement can be achieved using a linear line using a linear rail. A stepper engine is installed on each axis, which is the source of motion according to the control signal generated by the electronic circuit. Each car is connected to the screw fastening / screwing packing of each step from each level and is responsible for moving traffic movements. It is linear. The linear motion of each axis is equally linearly embedded, and each axis can give a linear motion by applying a load to each axis. Traffic movement directly controls traffic movement from each axis. The speed in each direction of speed can be directly controlled by the direct speed of movement required for the control signal. In this way, traces of the ultra-high efficiency flatbed device are cut by each axis to minimize or modify the work cutting operation. The electronic system includes Micro Control Board and Motor Control Panel C. Mach3 converts a typical PC CNC machine controller. It is very rich and works well with Windows applications and more customizable applications. Mach3 is the most popular CNC management software. The main features are as follows.

In 170, you can send DXF, BMP, JPG, and HPGL files directly using the G code display. Lazy-Cam Visual creates G code using Lazy-Cam or magician. Customizable, completely customizable M code interface.

VI. Project Machine Set-Up

1. The machine structure is the machine's "backbone". It combines all the cars in the whole system. Machine structure is very important for mechanical engineering, because it directly affects stable weakness and dynamic endurance and built-in response mechanisms. The carefully developed structures provide a high level of weakness, resulting in high speed operation and more precise operation. Smaller machines operate at a higher speed than usual, so they require higher speed than the usual large machine tools. Excellent thermal stability that ensures the size of the same size and the open door construction that is commonly used to ensure access to the workplace.
2. The closed frame structure is usually used with such precision. That's why it's much easier to move the tool to a fixed work piece. This structure consumes less material and therefore very cheap construction. Most machines used for cutting stainless steel plates will use the gaunt design, because it is the easiest way to navigate the cutting tool in the Z-X coordinate system.
3. The railway system with gantry rides creates one axis, as a rule, the Z axis. The Gantry Bridge itself creates another axis, usually the Y axis. By combining each of the axes of

the axis and the movement of the two axes, you can move the lamp pattern, which is necessary to remove the stainless steel plate. In this way, the gantry design is designed for CNC geometry cutting which mainly uses the Z-X coordinate system programming parts.

4. Gantry cutting machine will travel to one of the Z mirrors on one of the rail systems (installed on the floor or on the side of the table). The railway project aims to ensure the precision of the car and provide enough power to support the whole car and all the equipment associated with it.
5. Considering the size of the car, these rails should be as simple as a small piece of metal, or as hard as a columned linear railway system, as well as a railway railroad. The gantry cutting machine also has a guide system on the X crane that gives the bridge structure. The X axle guide system, as a rule, is usually the Z axis rail. We only support the weight of a small carriage and cutting tool, not the whole gantry.
6. Gantry car is a tool for carriage or multiple instrument wagons. Sometimes the instrument shipment will have its own automobile that moves them in the X axis accordingly, sometimes there will be only one X-axis moving engines and all the device carriages are connected to steel bands, tie rods, wire ropes or similar mechanical devices.

VII. Description of Components

1. *Ball screws*- ball screws are a mechanical linear that crosses the rotating motion in a linear movement with a small friction. The screw shaft provides a spiral path with a ball and ball functions as a precision screw. They can do with minimal internal friction. - Steel ball - Screw seafood - Ball hole - Seal (both sides of the ball screw nut) - Recycling section (pipe back etc.) Ball Bearing Ball Bearing is a type of rolling element bearing that maintains the spacing between bearing races using balls. The purpose of the ball bearing is to reduce rotational friction and to support radial load and axial load.
2. *Linear rod* -The linear rod is used to support the load without affecting the movement and an axis with a heavy intensity to support linear movement. Linear assembly is used with a linear assembly to support the load and to support the structure with a linear movement. Because the structure is fully loaded with the linear wire assembly, the load on the ball screw is reduced and a linear movement is precise and smooth.
3. *Linear sprays*- Linear bearings must move freely in a linear direction. Many linear bars and sliding plates with low friction release on linear rods. Linear bearings or linear slides are designed to move freely in any direction. There are different types of bearings for linear movements. Rolling body bearings usually consist of outer rings and countless sets of balls that contain cages. The cage was first constructed with solid metal and stamped. There is a smooth movement, low friction, high intensity and long life. They are economical and easy to maintain and exchange.
4. *Shaft end support*- shaft holder is used to firmly support the linear shaft / shaft without slipping. The shaft support block is lightweight and is used for end or intermittent support where slight bending of the shaft is not important.
5. *Shaft coupling*- A shaft coupling is a device used to connect two shafts to each other at its ends for the purpose of transmitting energy. The coupling generally does not allow disconnection during shaft operation or connection, but it may reduce coupling to the torque limit when the torque limit is exceeded. The coupling serves mainly to connect the two rotating machines.
6. *Stepper Motor*- The stepper motor is a brushless synchronous motor that converts digital pulses into mechanical rotation of the shaft. The motor position can be controlled by an open loop controller. The NEMA 23 stepper motor is a stepper motor with a size of 2.3 x 2.3 inches to control the movement of the spindle. The NEMA 23 stepper motor maintains a torque of 19KG-Cm. The NEMA 23 stepper motor has a step angle of 1.8 degrees with a nominal current of 2.5 A.
7. *Stepper motor Driver board*- Drive the DC motor. Stepper motors require stepper controllers to activate the phases in a timely manner to run the motor. ULN - 2003 is a micro-step drive designed for smooth operation. The NEMA 23 ULN-2003 Stepper Motor achieves a micro step using a PWM output drive. If the engine and driver do not match, the performance may be disappointing. To make matters worse, damage to the engine and controller.
8. *Microcontroller card*- The Atmega 328p Arduino Development Board is used as a motion control board. At mega 328 p is a 16-bit, 24-bit ARM microcontroller architecture. The microcontroller is emptied with the firmware of the interpreter GCODE written in the optimized language "C". Motion control is controlled by the microcontroller's firmware. The inputs of the microcontroller have inputs such as reset, power hold, cycle start / restart and axis restriction. J. Limit switches Limit switches are the simplest type of limit switch that switches to a trigger when the shaft reaches the end of its movement. The limit switch is used to protect the driver and to operate the switch once the shaft has reached its end. The signal pin of the limit switch is connected to the microcontroller plate to detect the end of the shaft.

VIII. Conclusion

With the increase. Small industries require small and high precision parts in various industries, and small machine tools are growing considerably. The manufacture of small components using small machine tools can offer both flexibility and efficiency to manufacturing methods and reduce capital costs, which is beneficial for small business owners. In this article, a small 3-axis CNC milling machine's components are analyzed under small budgets.

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