

Design And Fabrication of 3d Printed Arduino Based CNC Machine

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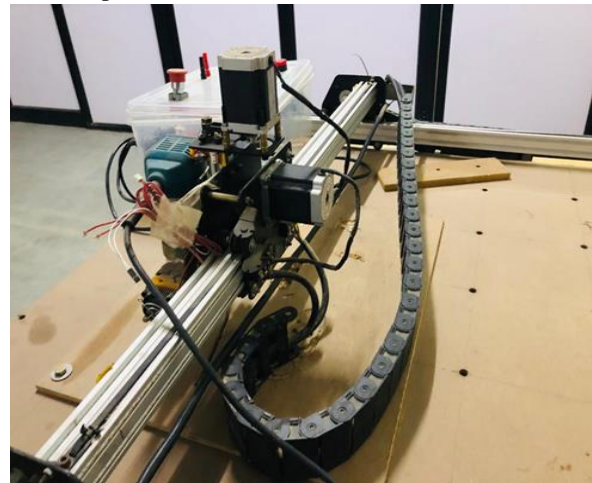
Abstract- In this project we are designing a low cost “3D Printed Arduino Based Lathe Cutter Machine” using stepper motor, Arduino Uno R3, micro controller software. The Software has been used to produce a G code for the operation of the system. The Arduino plotter machine has been dependent on the principle of Computer Numerical Control with limited area depends on the motion X, Y and Z axes. Basically, the system of this plotter machine is modeling by solid work software to work with three axes stepper motors (as X, Y and Z axes), these three stepper motors are controlled by shield for movement (X, Y and Z axes). This machine’s movement on the X axis is 215 mm and Y axis is 235 mm. Length of travel means the linear movement of stepper motors that control for X, Y and Z axes from point to another point. The left and right movement controlled by X axis stepper motor, front-back movement controlled by Y axis stepper motor and the pen is up-down that is controlled by Z axis stepper motor and uses two pieces one for front and one for back. The y-axis acts as motor mount to move z-axis in addition with slide mechanism whereas the z-axis controls the depth by allowing the movement of router in up and down direction so it is a very important axis.

Key Words-CNC, Arduino, G code, Micro controller unit

INTRODUCTION

Robotic systems and automation technologies have revolutionized various industries, including manufacturing and machining. In the context of machining, lathe cutter machines play a vital role in precision operations such as turning cylindrical work pieces to create symmetrical shapes, threads, and smooth surfaces. However, traditional lathe machines are often expensive, occupy significant space, and require complex maintenance. This led to the exploration of alternative solutions that are cost-effective, accessible, and customizable for small-scale machining applications.

In recent years, advancements in additive manufacturing and microcontroller technology have opened up new possibilities for creating affordable and versatile machines. This research focuses on the design, development, and implementation of a 3D printed Arduino-based lathe cutter machine that addresses these challenges. By leveraging the benefits of 3D printing and Arduino microcontrollers, this machine offers a cost-effective and accessible solution for hobbyists, educational institutions, and small workshops.



DESIGN & FABRICATION OF 3D PRINTED ARDUINO BASED CNC MACHINE

LITERATURE REVIEW

While there is a lack of direct studies on 3D printed lathe cutter machines, existing research on related topics provides valuable insights. For instance, studies have demonstrated the successful development of 3D printed robotic arms controlled by Arduino boards, showcasing the potential of this integration. These investigations emphasize the versatility, ease of programming, and cost-effectiveness that Arduino

brings to the realm of 3D printed machines. To date, no comprehensive study has specifically addressed the development of 3D printed lathe cutter machines. This research paper aims to fill this gap by exploring the integration of 3D printing and Arduino technology to design and construct a cost-effective and accessible lathe cutter machine. Cost of the project and increase Reliability and Flexibility. In we have replace pen with mechanical tools drilling, grinding, machining etc. This will be used for soft material cutting or machining, laser cutting machine tool is also worked on this setup. We have reduced the cost, in the setup of CNC plotter machine.

1. CNC machines can be used continuously 24×7 throughout the year and only need to be switched off for occasional maintenance.
2. CNC machines are programmed with a design which can then be manufactured hundreds or even thousands of times. Each manufactured product will be exactly the same.
3. Less skilled/trained people can operate CNC machines unlike manual lathes / milling machines etc. which need skilled engineers.
4. CNC machines can be updated by improving the software used to drive the machines
5. Modern design software allows the designer to simulate the manufacture of his/her idea. There is no need to make a prototype or a model. This saves time and money.
6. One person can supervise many CNC machines as once they are programmed they can usually be left to work by themselves. Only the cutting tools need replacement occasionally.

Various authors have studied the development of such machines. ‘Fabrication of Low Cost 3-Axis CNC Plotter Machine. Venkata Krishna Pabolu et al. Nov 2010: “Design & Implementation of a three Dimensional CNC Machine”. It increases the demand for flexibility and cutting with respect to edge quality. It maintains the accuracy and reliability for complex shapes. In this system they used visual C# as a language on .NET platform. In this there are three main kinds of computerized numerical controllers: 1. Multiprocessor with ASIC, 2. PC front end, 3. Motion control card with PC. The design of this system is user-friendly one which give accurate results and also flexible to users. RTOS is very costlier and not user friendly and also with such system it is not possible to

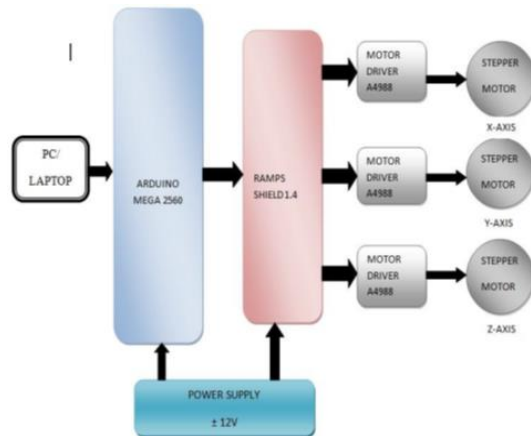
implement on any general PC, where user has to purchase the operating system. Sundar Pandian 2014: “develop low cost 3 axis CNC machine”. It is low cost and it is used currently in the laboratory. Stepper motors with drivers, Arduino open source, and microcontroller and open source motor control software. Author used ready to assemble kit from Zen Tool works, USA. Kit provided stepper motor, lead screw, guide rod, anti-backlash falans and spring. He made the Body with high density PVC. The machine has fix gantry and mobile bed so there is restriction in working area. The model provides more scope for handson learning by the students and therefore better learning outcomes. It is developed for only educational purpose. Kajal J. Madekar, Kranti R. Nanaware, Pooja R. Phadtare, Vikas S. Mane Feb 2016 “Automatic mini CNC Machine for PCB drawing”. To develop low-cost automatic mini CNC machine for PCB drawing. This system reduces the cost of machine and increases the flexibility. In this G code is interfaced with ATMEGA 328. CNC based controller by FTDI module which is used to convert the code in convenient controller the code i.e. serial to USB converter, x moves to left, Y moves to right and z moves to up and down. It gives better accuracy and reduces the work load. G code mark easy to find the information of locations of all stepper motor moving. In the GRBL support 3 axis of motion X, Y and Z but does not support rotation axes (X, Y).

METHODOLOGY

“DESIGN & FABRICATION OF 3D PRINTED ARDUINO BASED CNC MACHINE” is a modification in which a traditional lathe is integrated with a computer system. In this machine, the workpiece rotates at high speed, and a computer-controlled cutting tool machines the workpiece to produce axisymmetric parts with high accuracy. It can be used for machining various metals and non-metals.

1. A computer numerical control (CNC) lathe is a versatile machine that can be used to make different parts from metals using operations such as turning, facing, and grooving.
2. It is one of the most widely used machine tools in subtractive manufacturing.
3. The primary function of a CNC lathe is to turn axisymmetrical parts with high accuracy. You can also

use it for cutting threads, drilling holes, and milling shapes.



Working Diagram”

BENEFITS

After the manufacture of the machine, we got some results which concluded a lot of properties.

1. The machine is fast and easy to use , there is no need of largely professed drivers.
2. Cost Efficient – High cost of machine is a common & huge problem for Startup, small machinists, But this machine is designed to do such particular jobs & it is customizable too.
3. Portable – Other machines available in the market are quiet heavy in weight and can't be moved from one place to another for use while this machine is portable and can be shifted from one place to another easily.
4. CNC Lathe is a versatile machine that can be used to make difficult parts from metals using operations such as turning, facing, grooving etc. It is of low cost and easy to control.

Hence, I have successfully studied about CNC machine tool & their functions. With their G & M codes & operations performed on these types of machine tool. 3D Printed Arduino Based CNC Machine is really limitless & only the surface has been scratched, there is still much more to be uncovered.

CONCLUSION

In this design, we've presented the conception of a low cost three axis CNC plotter. Our CNC plotter overcomes these problems of low cost and easy to control and there's no need of largely professed

drivers. It can be used for long hours at a stretch which isn't possible in being bones FUTURE compass 3D printing has long passed the point of being viewed only as a prototyping result. Everyday, companies are chancing new ways to incorporate the technology into their product, with operations ranging from driving to spare/ relief corridor and some end- use factors. From automotive to consumer goods, companies across diligence are getting apprehensive of the advantages 3D printing offers for product. According to Sculpteo's 2019 State of 3D Printing report, 51 of companies are laboriously using 3D printing for product.

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