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RESEARCH ARTICLE OPEN ACCESS

DIY Arduino Based Mini CNC Machine

Monica Lakshmi R[1], Monisha Garrepelly[2], Marella Nikhitha[3]

Asst. Professor[1], Department of Computer Science and Business Systems, R.M.D Engineering College, Chennai, Tamil Nadu, India. Email : mlr.csbs@rmd.ac.in

Student[2], Department of Computer Science and Business Systems, R.M.D Engineering College, Chennai, Tamil Nadu, India. Email : ucb20125@rmd.ac.in

Student[3], Department of Computer Science and Business Systems, R.M.D Engineering College, Chennai, Tamil Nadu, India. Email : ucb20124@rmd.ac.in

ABSTRACT:

A CNC XY plotter is required to plot two-dimensional continuous or discrete data in a Cartesian coordinate system. This project is done to create an XY plotter with independent movements along the X and Y directions and a microcontroller system (Arduino) to control these movements. The implementation of this project is done via a computer connected to the Arduino software operated via Benbox software.

INTRODUCTION:

The CNC XY Plotter Machine is a 2D plotter machine that uses a pen to draw text or images, continuous or discontinuousdrawings onto any solid surface. CNC plotting is one of the most commonly used plotting methods in a variety of applications. Since the introduction of computer numerical control in the 1960s, CNC machines have become an integral part of industrial and commercial manufacturing processes. Computer Numerical Control is the process of using computers to control tools to manufacture different types of products. Special software and consoles are required to operate these machines. The computer program is customized to the work piece and the machine is programmed using the CNC Machining Language (G-Code) which essentially controls all characteristics of the final product such as alignment, position and speed.

OBJECTIVES:

1. Construction and design of electromechanical devices capable of generating continuous or discontinuous vector graphics on solid surfaces.
2. To minimize manufacturing costs.

LITERATURE SURVEY:

NurShazwanyZamani (M.N. Mohammed created a cheap handwriting robot based on CNC foundations. This handwriting robot consists of a motor driver shield to move the pen in the X and Y directions. A servo motor to move the pen up and down on the Z axis.For this writing, is created and the Inkscape software is uploaded to directly generate the G-code.The microcontroller controls the movement of the motors and the required drawings Create a.

Md. MahediHasan published a paper on "Design and implementation of a low-cost computerized NumCNCerical control (CNC) plotter using a motor driver controller based on the CNC Maha microcontroller". Convert human speech to text using an x-y plotter. Commands to the machine were given by acontroller connected to his CNC machine via Bluetooth communication. The writing mechanism is made by his voice recognition technology.

R.Augustian Isaac presented a simple prototype "HOMEWORK TYPEMACHINE" is a programmed machine used to write all kinds of content, draws arbitrary contours of an image on paper To do.This machine is chipped at three pivot points which are the axes (X, Y,

Z). This 3-axis movement is controlled by stepper motors and servo motors.
ShaniRanjan's article "Design and Implementation of a Low-Cost 2D Plotter Computer Numerical Control (CNC) Machine" introduces the, an Arduino Uno, and a motor driver IC based on any text implementation technique or image. I'm here.A simple prototype "Automated Writing and Drawing Machine" by M. Aditi S. Karpagam designed a mechanism programmed with a speech recognition system, where the userwrites what he/she speaks. .
A Simple Prototype of "Arduino UNO-Based Two-Way [2D] Plotter Implementation" by Sheetal N. Patil has designed a handy model of a plotter machine that can write text according to voice commands. The ATmega328p microcontroller converts the G-code into a number of machine languages and then sends them to the 2D-plotter's motor driver.

Article by AbhijitGhule on Mobile Application Based Voice Command Wireless CNC Writing Machine. Use two scraper DVD/CD stepper motors (x and y axes) connected to two L298 motor drivers and a servo motor connected to a pen motion control (z axis) to draw arbitrary text. Draw. Image per Fed program. Article on "Wireless Base CNC Mini Plotter Three Axis Control Machine" by GhulamDastgeer, Prof.

Muhammad Asad developed a low-cost wireless CNC mini plotter, the 3-axis control machine combined with a microcontroller. Did. The wireless CNC machine consists of stepper motors and servo motors and can draw pictures and signatures according to your requirements. This system uses HC-05 Bluetooth wireless communication element, his two stepper motors for the rotary axis, and his servo motor for his Z axis.

METHODOLOGY:

1.DESIGN OF CNC MACHINE:

In this study, the X-Y plotter is designed to record and plot two-dimensional data in a Cartesian coordinate system. The choice of material for the mechanism was made with cost and wide application considerations in mind. B. As a servo motor. Servo motors are differentiated by cost, maximum torque capacity, and speed range, which influence system standards and applications. Development of an XY gantry model consisting of dual drive servomechanism dynamics and her two motors for Y control. Another motor shifts the gantry in the X direction. In this design, for movement in the Y direction he uses two parallel rails with rods that hold the system's end effectors extending across the rails. On the other hand, plotting accuracy is a big issue in the manufacture of X-Y plotters. There are very few

articles devoted to plotters on how to adjust plotter accuracy and motion. The X-Y plotter system is a simplified system compared to the CNC system as it runs in his 3 axis directions and programming is more complex. Still, Benbox can be used for his 2-axis movement. This is the ability to tell the machine to go to different points at the desired speed, control the spindle speed and turn on and off different coolants. In this X-Y plotting system, the part programmer uses G-code to specify the coordinates of a point to move and give the point a normal vector to the surface. As for the core system, the inventor is best known for his Arduino system, which is mostly used in most electronic components due to its compatibility with the system and hardware. On the other hand, the low cost and easy-to-control features of the Arduino system helped simplify the circuitry of the X-Y plotter's microcontroller.

2.PROBLEM STATEMENT:

Compared to the previous CNC writing machines, our writing machine is cost effective because our machine makes use of the old DVD writers. It is made from scrap. It is lightweight hence easily carriable and portable.

3. WORKING:

As one of the stepper motor rotates counter clockwise, the servo motor driven pen holder

moves along the X axis. As the stepper motor rotates clockwise, the servo motor-driven pen holder moves left along the X axis. As the other stepper rotates counter clockwise, the base of the letter moves up along the positive Y axis with the paper. As the stepper rotates clockwise, the base of the letter moves down along the positive Y axis with the paper. The pen holder mechanism we use is unconventional but effective. A servo motor push and pull the pen, up and down.

4. MAIN PARTS OF CNC PLOTTER:

4.1 ARDUINO UNO:

Arduino UNO is a microcontroller board that uses the ATmega328P microcontroller. The board has 14 digital I/O pins, 6 analog inputs, a 16MHz crystal, a USB connector, a power jack, an ICSP header, and a reset button. Arduino uses input programs to control the movement and position of stepper motors.

4.2 STEPPER MOTOR:

Stepper motors are an integral part of CNC plotter machines as they control the accuracy and speed of the system. A brushless synchronous motor. Stepper motors help control precise and precise movements in the X and Y axes. The movement and position of the stepper motor are performed without any feedback mechanism. H. It is based on open loop control system.

4.3 SERVO MOTOR:

A servo motor is an electrical device that rotates an object with high precision. Widely used in remote control toys, drones, robots, printing machines, etc. An application of servo motors in CNC plotter machines is to control the up and down movement of the pen. This action is implemented by sending pulse width modulation. If the pulse value is 90 degrees, the pen moves up. Otherwise, if the value is as low as 0 degrees, the pen moves down. The pen moves up and down along the Z axis.

4.4 STEPPER DRIVER:

A stepper driver receives a pulse signal and rotates a motor by a specific angle in a specific direction. The l293D motor driver was used in the project.

4.5 CNC SHIELD:

Arduino CNC shields provide an Arduino microcontroller with the power necessary to drive stepper motors and run all the other functions that contribute to a CNC machine's operation. Depending on the shield, this could include end stops, spindle speed control, and probing.

5. BLOCK DIAGRAM:

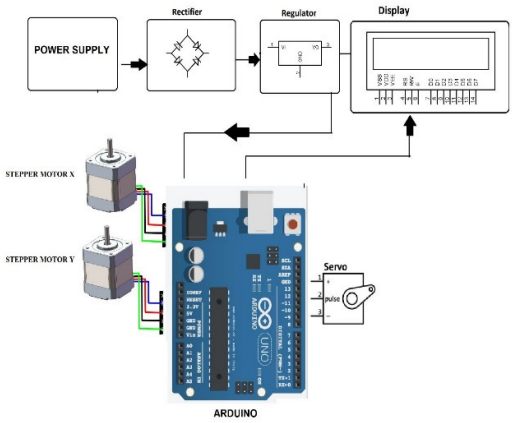

Fig 1 Block diagram

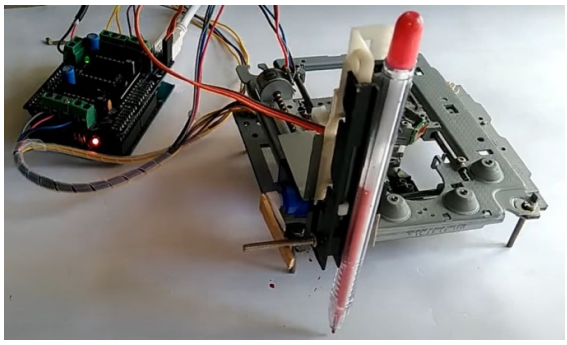

Fig 2 Writing and Drawing CNC Machine

PROPOSED SYSTEM:

Our CNC writing machine is a 2D XY plotter that makes use of a tool such as a pen or a pencil to write any kind of content or draw any figure on a paper. Stepper moters in DVD writers are used to move the writing tool in X or Y direction.The CNC shield allows us to control the 2 stepper motors simultaneously.

The microcontroller board, Arduino UNO is integrated with our machine. Our writing

machine is cost effective compared to the previous CNC writing machines, because of the usage of the old DVD writers in our machine. It is made from scrap. It is also easily carriable and portable since it is lightweight.

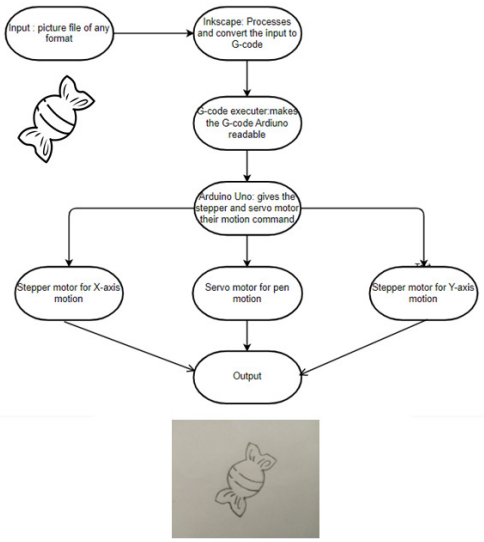

Fig 3 Flow chart

FUTURE WORK:

I. By adding a Z-axis mechanism, the same mechanism can be used for 3D printing.

II. By replacing the pen holder parts, it is a model that allows drilling, PCB fabrication, and laser engraving.

lll. By introducing a new pen holder we can change the pen that we prefer anytime such as a ball pen, ink pen, gel pen, etc..

lV.By making multi refill pen accessible.

CONCLUSION:

To conclude we have made a CNC plotter with the concept of low cost and more efficient than the existing CNC machines. Our CNC machine can be used by novice users too unlike the already existing CNC machines which require expert operators who are highly skilled. Our CNC is smaller in size and comes in handy.

REFERENCES

[1] G. H. Joseph, "Xy plotter," ed: Google Patents, 1969.

[2] G. H. Joseph and D. J. Logan, "Xy plotter," ed: Google Patents, 1966.

[3] M. Sakamoto, R. Magumo, T. Ishihara, and T. Kobari, "XY plotter for non-perforated paper," ed: Google Patents, 1990.

[4] J. Yeiser, "Xy plotter," ed: Google Patents, 1973.

[5] R. Krishnan, "Selection criteria for servo motor drives," Industry Applications, IEEE Transactions on, pp. 270-275, 1987.

[6] R. D. Bloom, J. V. Gac, and E. T. Kozol, "Programmable servo motor speed control apparatus," ed: Google Patents, 1986.

[7] H.-K. Park, S.-S.Kim, J.-M.Park, T.-Y. Cho, and D. Hong, "Dynamics of dual-drive servo mechanism," in Industrial Electronics, 2001. Proceedings.ISIE 2001. IEEE International Symposium on, 2001, pp. 1996-2000.

[8] M. Iri, K. Murota, and S. Matsui, "An approximate solution for the problem of optimizing the plotter pen movement," in System Modeling and Optimization, ed: Springer, 1982, pp. 572-580.

[9] G. Ghiani, D. Laganà, and R. Musmanno, "A constructive heuristic for the undirected rural postman problem," Computers & operations research, vol. 33, pp. 3450-3457, 2006.

[10] H. J. Gerber, "Error correcting system and method for use with plotters, machine tools and the like," ed: Google Patents, 1971.

[11] G. Ghiani and G. Improta, "The laser-plotter beam routing problem," Journal of the Operational Research Society, vol. 52, pp. 945-951, 2001.

[12] M. Sakamoto, R. Nagumo, and T. Ishihara, "XY plotter drive roller arrangement," ed: Google Patents, 1987..

[13] D. P. Desai and D. Patel, "Design of Control unit for CNC machine tool using Arduino based embedded system," in Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), 2015 International Conference on, 2015, pp. 443-448.

[14] V. Athani, "The 16-Vector Algorithm for Computer Controlled Digital XY Plotter," Computers, IEEE Transactions on, vol. 100, pp. 831-835, 1975.

[15] J. Martin and D. Dalzell, "An economical intelligent plotter," Radio and Electronic Engineer, vol. 48, pp. 573-579, 1978.

[16] Z. Chengrui, S. Cheng, and W. Heng, "DESIGN AND REALIZATION OF G CODE INTERPRETER FOR CNC SYSTEM [J]," Journal of Shandong University of Technology, vol. 6, p. 016, 2002.

