iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** III **Month of publication:** March 2019

DOI: http://doi.org/10.22214/ijraset.2019.3064

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue III, Mar 2019- Available at www.ijraset.com

Wireless Mini CNC Plotter

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Abstract: ***In this paper we are designing a low cost three axis wireless Mini CNC Plotter using stepper and servo motor, Arduino microcontroller and motor control software with wireless Zigbee module. In 17th century various works like cutting, drilling etc. was doing with the lathe machine and boring machine. But for that work requires skilled labours and regular monitoring is required. At invention time of modern CNC machine three axis curvature data was used. That was developed by John Parsons in 19th century. But the having very much high cost and its construction is difficult. To overcome this we are trying to make small and low cost CNC plotter with wireless facility.***
Keywords: CNC, Arduino Microcontroller, Interpolator, Zigbee.

I. INTRODUCTION

In the world of Computer technology, numerical control is an advanced sector in the form of soft automation developed to control the motion and operation of machine tools which are being used in industries like automobile, health, ginning and printing etc. CNC is the numerical control machine was invented at 19th century, to reduce work load. It has advantages like high efficiency, high flexibility, high production ratio and low cost. It has less working time & fewer losses in production. It has three main steps that are receiving data, interpreting data & accordingly control action. A plotter is the spherical type of printer that uses a pen to draw images on solid surface. In computer Numeric Control (CNC), Microprocessor is used which is capable of processing logical instructions interfaced with computer. the logical instructions are provided by using a computer in the form of code or text or images which is then transformed into machine language by microprocessor to be executed by the machine .A CNC plotter machine is 3D controlled 2D plotting machines which uses a pen to draw text or images on any given solid surface. It can be used for the purpose such as PCB Design, Logo design etc.

Wireless mini CNC plotter machine is based on ARDUINO controller and CNC shield. CNC is a computer numerical control machine. G codes preparatory function. G codes are predefining function associated with the movement on machine axes. In CNC plotter machine only codes are used to make the particular job as per requirement. G codes are used in giving the direction to move the pen in X, Y, Z directions. Pen can be changed by tools of drilling, laser cutting, milling it can be worked, and it can be made in large size. The aim of the wireless mini CNC plotter machine is capable to draw complex design in paper or plane surface of metal to cut it with a consistent accuracy. We have used three motors with lead screw in Cartesian co-ordinates X, Y, Z directions. Motor converts digital pulses into lead screw rotations. Motor drivers are used to give command to the system. The main aim is to use wireless mini CNC plotter machine is to draw an job with using G codes as per requirement. We also work on to reduced.

II.BLOCK DIAGRAM DISCRIPTION

A. Transmitter Side

Fig. block diagram of Transmitting side of mini CNC plotter

Transmitter side consist of a personal computer in which we convert image file into G code file using inkscape software. 'Sketch it' is another software which is used for processing and interfacing purpose which gives command to mini CNC plotter. And Zigbee board is used to make it wirelessly So transmitting Zigbee module is connected to computer using MAX 232 serial port.

B. Receiver Side

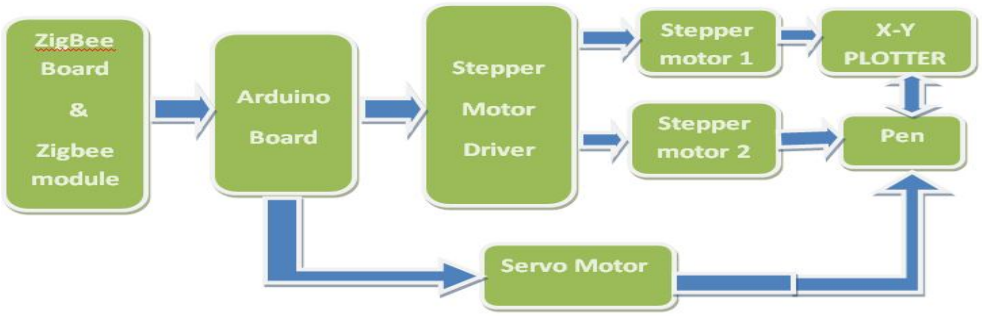

Fig. block diagram of receiving side of mini CNC plotter.

Zigbee modules receives signal given by user which is connected to main arduino board. IC293D is motor driver module which drives two motors in X and Y axis simultaneously.in which stepper motor 1 is connected to XY plotter and another is connected to pen. Servo motor works in Z axis for up-down position of pen.

III. HARDWARE

1) *Stepper Motor:* Stepper motor is DC motor that moves in discrete steps. They have multiple coils that are organise in groups called phases. The motor will rotate in sequence one step at a time. It converts digital pulse into a movement of pen with respect to X, Y Direction. A stepper motor is a brushless motor which split a full rotation into a number of equal movements, the stepper motor is known by its property to turn a no of drive into a defined increment in the shaft position. Each pulses move the shaft through the fixed angle.

Fig. Stepper Motors

2) *Servo Motors:* A Servo motor has an entirely different story. The function of Servo motor is to receive a control signal that represents a desired output position of the Servo shift and apply power to its DC Motor until its shaft turns to that position. Servo motor works on PWM principle means its angle of rotation controlled by duration of applied pulse to its controlled pin. Basically servo motor is made up of DC motor which is controlled by variable resistor and some gears.

Fig.ServoMotors

3) *Zigbee:* Zigbee is used to create personal area network with the help of low and small power digital radios. It is used for home automation, medical device data collection, other low power low bandwidth needs which used for designed for small scale projects which need wireless connection. Zigbee is low cost and low powered mesh network widely used for controlling and monitoring applications. Zigbee device covers10-100 meters range. Zigbee technology is low cost technology and this technology is simpler than other technology which are used as wireless sensor network as Bluetooth and Wi-Fi.

Fig. Zigbee

4) *Arduino Microcontroller:* Arduino is an open source platform electronic device based on easy to use hardware and software. Arduino board is able to read the inputs like light on sensor, a finger on a button. Using set of instructions to the microcontroller we can tell Arduino what to do. Actually Arduino is a micro controller board based on the AT Mega 328 (Datasheet). It having 14 digital input or output pins 6 Analog Input, A 16 MHz ceramic resonator, a USB connection, A Power Jack, ICSP header and a reset button. It has everything which is needed to control Microcontroller. It is connect to the computer with the help of USB cable or Power it with an AC-DC Adapter or used Battery to start the process. The Arduino can be powered with the use of USB connection or with an External power supply. External power is provided either from AC-DC Adapter or with the help of Battery. External supply of 6 to 20 volts is used to operate Arduino board.

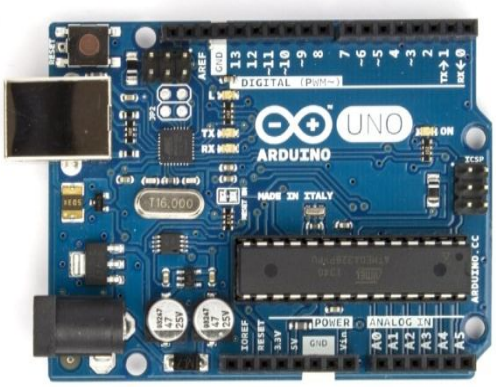

Fig. Arduino Microcontroller

5) *L293D:* It's the typical motor driver or motor driver IC. It allows DC motor to drive on specific direction. L293D is the 16 pin IC which controls the movement of two motor simultaneously in any direction. So we can say that we can control 2 motors at a time with using of IC L293D.

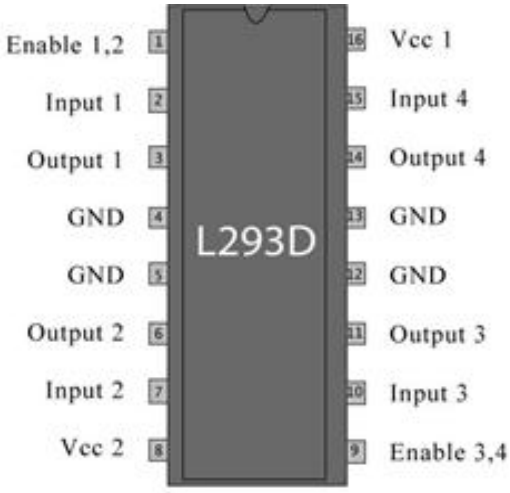

Fig .IC L293D.

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IV. SOFTWARE

1) *Inscape:* It is a free and open source vector graphic editor**.** It can used to make diagram, logos and critical paintings. This software is used for convert the images and objects into the required format E.g.: G-code.
2) *Processing Software:* The 'SKETCH IT' is the name of software that Arduino uses for program. It is unit of code that is uploaded to and run on an Arduino board. Processing software is open source programming language software which is used for electronic drawings. The port of Arduino is selected by pressing 'p'. And 'g' is used to upload our desired G-code file.

V. WORKING

We have supply the current in Arduino with USB Data cable to transfer data from computer to Arduino board, here we have used to Stepper motor Drivers to supply G-Codes in sequence to the Stepper motors. Arduino will be mounted on CNC shield. CNC shield will be distributing the current in the command of Arduino. CNC shield will be converting the command of G-codes in digital pulse by Stepper motors. In X Direction Stepper motor will move left & Right, Y Direction Stepper Motor will be move in front and Back direction, Z Direction Servo motor will be move in Up & Down direction. Zigbee circuit is basically used to make it wireless. We have made many difficult designs via using this machine. The accuracy of these machines results is very high. For reduce cost of printing, design of tools, logos & maintain the punctilious CNC plotter is used in industry.

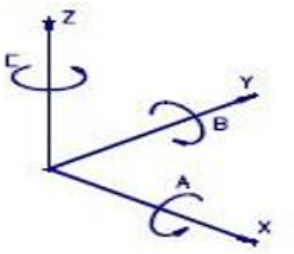

Fig. The CNC axes

VI. SCOPE

If the pen of the machine is replaced by the laser, we can use it as a cutting machine tool. The pen is also can be replaced by powerful drill which can be for milling and drilling application. The DC Servo motor can replaced with a Stepper Motor & Pen with a 3D Pen to make it a 3D Printer which can be print the objects with proper dimensions.

VII. PHOTOS

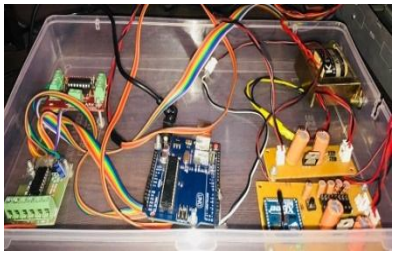

Fig.1 Circuit set up of mini CNC plotter

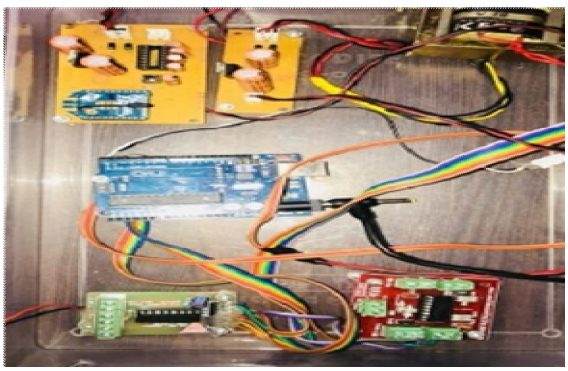

Fig.2 Circuit set upmof mini CNC plotter

Fig.3 Mini CNC plotter

VIII. CONCLUSION

In this paper we have presented our view of a low cost wireless mini CNC plotter. The present CNC machines having high cost, maintenance is complex and difficult and also has to operate by skilled operators. Our CNC plotter overcomes these problems. Our CNC plotter is easy for operate by any less skilled operator. This mini CNC plotter is wireless so we can operate this machine from long distance. So we hope that used this work for future development.

IX. ACKNOWLEDGMENT

We would like to express our special thanks to our mentors Prof. Dongarsane C.R. for supporting and guiding us in completion of this project and we would also like to thank Electronics and Telecommunication Department of Sanjeevan Engineering and Technology Institute, Kolhapur for giving us this wonderful opportunity to express our technical skills through this project.

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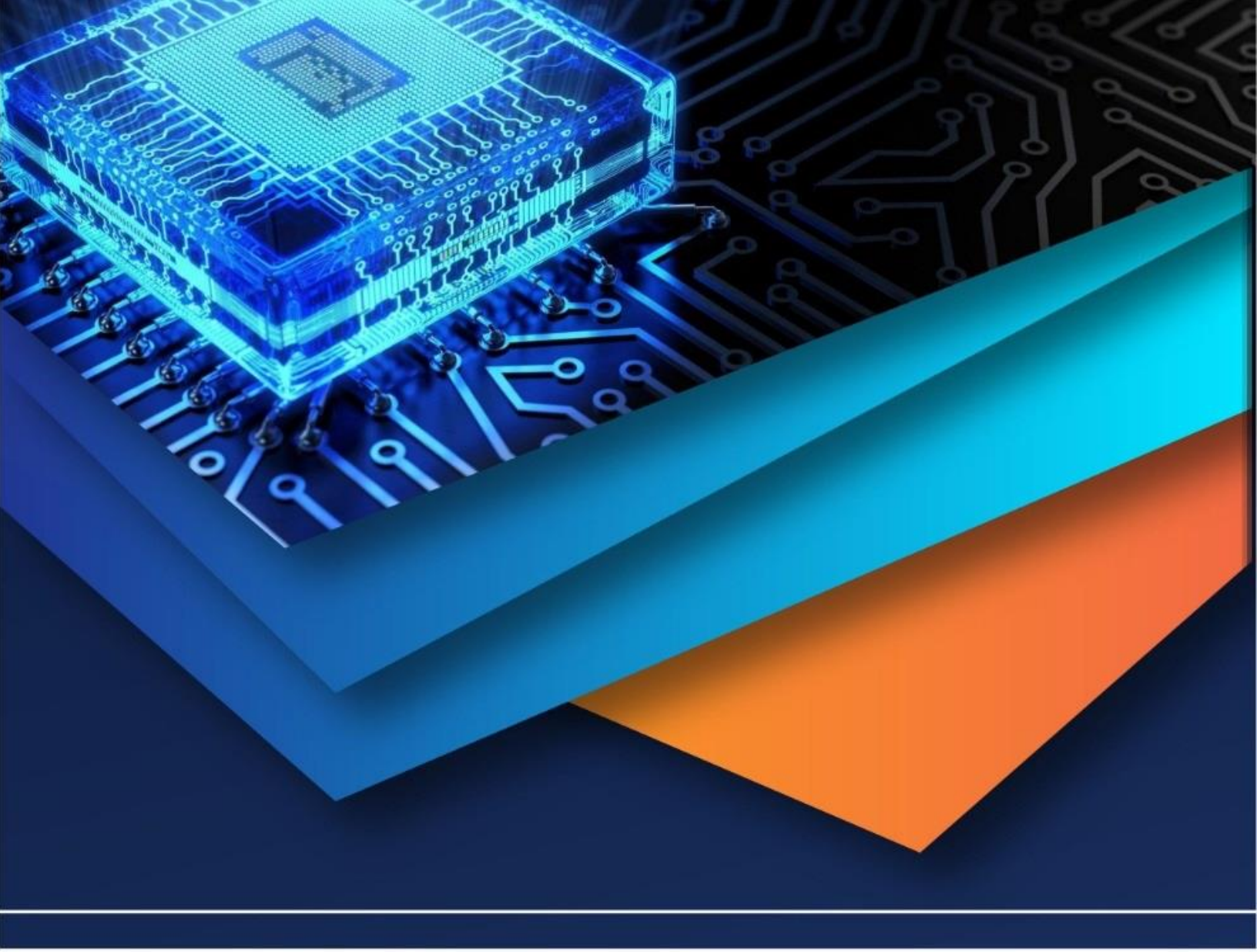

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