International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 07 | July -2020 ISSN: 2582-3930

DESIGN AND DEVELOPMENT OF CNC LASER ENGRAVER.

Kaustubh Shetake BE student, KIT's College of Engineering, Kolhapur. Shivaji University, Gokhul Shirgaon-416234 Kolhapur. (India)	Viresh Gaddi BE student, KIT's College of Engineering, Kolhapur. Shivaji University, Gokhul Shirgaon-416234 Kolhapur. (India)	Vaishnavi Shetake BE student, KIT's College of Engineering, Kolhapur. Shivaji University, Gokhul Shirgaon-416234 Kolhapur. (India)

Abstract- *CNC Machining is a process used in the manufacturing sector that involves the use of computers to control machine tools. Tools that can be controlled in this manner include lathes, mills, routers and grinders. The CNC stands for Computer Numerical Control***.**

Index Terms- About four key words or phrases in alphabetical order, separated by commas. Keywords are used to retrieve documents in an information system such as an online journal or a search engine. (Mention 4-5 keywords)

I. INTRODUCTION

On the surface, it may look like a normal PC controls the machines, but the computer's unique software and control console are what really sets the system apart for use in CNC machining. Under CNC Machining, machine tools function through numerical control. A computer program is customized for an object and the machines are programmed with CNC machining language (called G-code) that essentially controls all features like feed rate, coordination, location and speeds. With CNC machining, the computer can control exact positioning and velocity. CNC machining is used in manufacturing both metal and plastic parts.Inspiring from this CNC technology and revolutionary change in the world of digital electronics &Microcontroller, we are presenting here an idea of "Arduino Based CNC Machine Controller". The idea behind this concept is to make a small Two Axis CNC router which can engrave 2D & Gray scaled images or pictures with help of high watt burning laser module on surface which can be a paper, wood, leather, plastic, foam etc. It uses two stepper motors as linear actuators on each axis X, Y. While engraving, the proper synchronizationof all this axis i.e. stepper motors, is most challenging task.

II. R&D, LITRATURE AND MARKET SURVEY

This focuses on the related fields and knowledge pertaining to the accomplishment of the thesis itself. Reading includes such as reference books, papers, websites, conferences articles and any documentation concerning the related applications and research works.

- AT LOW COST BUILDING THREE AXIS CNC MILL PROTOTYPE:

  Modern manufacturing industry has become highly flexible and specialized due to the use of computer numerical controlled machines and robotic systems. This has been necessitated by the emergence of planned obsolescence, popularity of high-tech gadgets with short lifetimes, and popularity of fast-changing fashion items like clothing. As a result, computer aided design (CAD), computer aided manufacturing (CAM), CNC technologies, and robots are at the heart of flexible manufacturing systems (FMS) and computer integrated manufacturing (CIM). Laboratory education in CAD/CAM software and CNC machine programming and operation is central to the teaching of mechanical, manufacturing, and production engineering students at the undergraduate level.low-cost, desktop design and evaluation of a CNC machine for modeling and educational purposes. The working dimensions are 180x140x250 mm. The static rigidity and positional accuracy of the machine are experimentally measured. The PC is interfaced with low-cost embedded microcontrollers through the serial port. The CNC machine designs on the use of stepper motors of limited power in open loop mode.

III. SYSTEM DESIGN

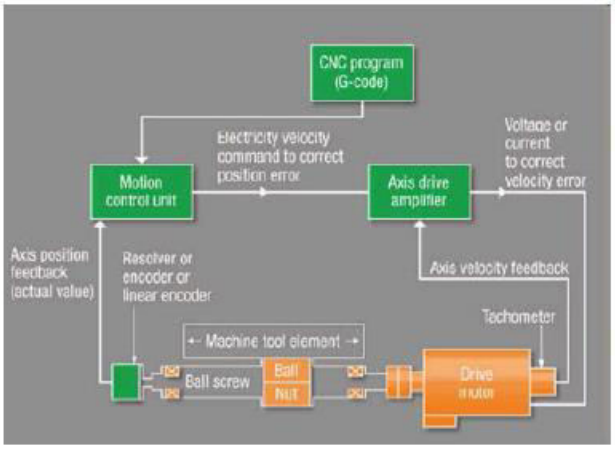
3.1 **3-AXIS CNC MACHINE:**

A Mechanical system:
To speed up the development of the CNC prototype system, a ready-to-assemble CNC carving machine kit from Zen Tool works, USA has been used in this work. The kit is supplied with three stepper motors for the three axes, the frame parts, the lead screws, guide rods, anti-backlashfalans and springs, and related accessories. The body of the machine is made of high-density PVC boards. It has a fixed gantry and a mobile bed, and therefore a limited working range which however compares well with the specifications of the commercial CNC mill. currently under use in our laboratory.

3.2 **2-AXIS CNC MACHINE:**

The main component of factory automation is the CNC which provides a set of functionalities for management of machine tools (MTs). The adoption of CNC for controlling 17 MTs, instead of using classical PLC's (programmable logic controllers), provides support for implementing complex strategies and thus forbuilding complex MT's such as Milling -Machines, MMs, for templates, for rapid prototyping and for producing models.
Currently there are three main kinds of computerized numeric controllers the:

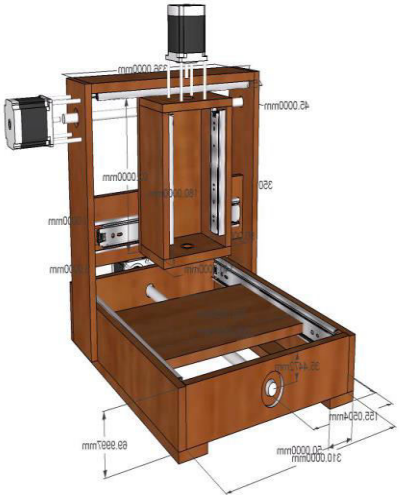
- Multiprocessor with ASIC (application specific integrated circuit): This allows high integration and ensures great reliability.
- PC front end: This is a traditional CNC black box with a personal computer added on.
- Motion control card with PC: This system is configured by rigging a motion control board in a commercial pc.



ARCHITECTURE OF MACHINE

IV. METHODLOGY

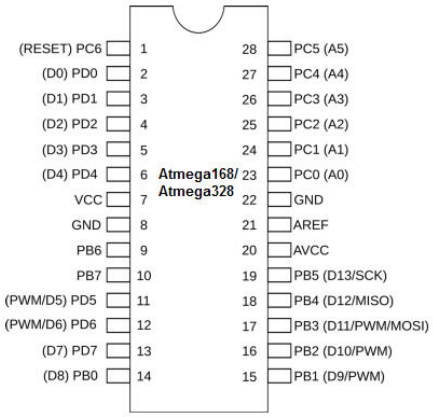
As proposed idea, the machine will be built within a miniature structure. Entire structure will be built from wooden or aluminum sections. To keep a lowest weight & cost as possible, wood will be preferred. The X, Y actuators will be made with high torque industrial stepper motors & Timing Belt – Pulley combinations. The stepper motors will be driven by A3967 based micro stepping stepper motor drivers. It drives & controls the operations of stepper motor by using STEP-DIR algorithm. It provides high current play on each coil of stepper motor. It controls the stepper by giving supply voltage directly to the coils of the stepper motors (Bipolar Logic). The high watt Ultraviolet Laser diode is used to engrave objects which has ultimate burning power. The brain behind the system will be AVR ATMEGA 328 Based control unit with Arduino programming structure. Arduino is today's most popular open source hardware prototyping platform. Arduino will receive the G-Code over serial port from the G-code interpreter & sender utility tool running on PC and will give the actuation commands to the stepper motor controller.



ASSEMBLY OF 2-AXIS CNC MACHINE

V. HARDWARE

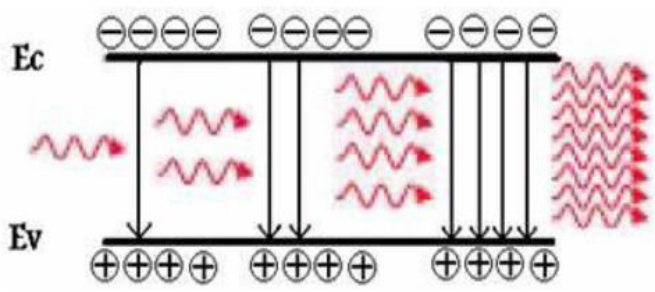
5.1.1 Microcontroller ATMEGA328:



- Clock Speed : 16 MHz|
- CPU : 8 bit
- Operating voltage : 5 V
- Input voltage : 7-12 V
- Digital I/O pins : 14
- Analog Input pins : 6
- DC current per I/O pin : 40 mA
- Performance : 1MIPS at 1MHz
- Flash Memory : 32Kb
- SRAM : 2Kb
- EEPROM : 1Kb

5.2 LASER

Light amplification by stimulated emission of radiation, or laser in short, is a device that creates and amplifies electromagnetic radiation of specific frequency through process of stimulated emission.



SIMULATED EMISSION OF PHOTON.

5.3 STEPPER MOTOR

Stepping motors fill a unique niche in the motor control world. These motors are commonly used in measurement and control applications.Sample applications include ink jet printers, CNC machines and volumetric pumps. Several features common to all stepper motors make them ideally suited for these types of applications.

STEPPER MOTOR

5.4 BIPOLAR MOTOR

Bipolar stepping motors are composed of two windings and have four wires. Unlike unipolar motors, bipolar motors have no center taps. The advantage to not center taps is that current runs through an entire winding at a time instead of just half of the winding.

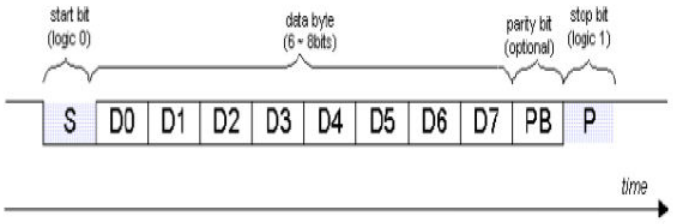
5.5DRIVER:

It is typical motor driver or motor driver IC which allows DC motor to drive on either direction. It is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single IC.

5.6 POWER SUPPLY:

This is an important block why because all the components require power supply to be operating. Micro controller requires +5v, relay and DC motors require +12v. In the transmitter a 9v battery is used and a voltage regulator in order to derive the required power supply for the micro controller i.e., 5v. And in the receiver as we require a maximum of 12v we are using a 12v battery to operate the relay and the DC motors. Again voltage regulator is used to derive 5v DC.

5.7 FORMAT OF COMMUNICATION:



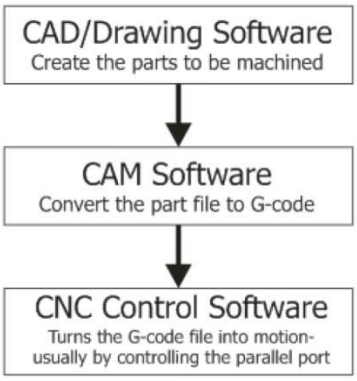
Basic UART packet format: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit.

UART Characteristics:

- The speed of communication (measured in bauds) is predetermined on both ends.
- A general rule of thumb is to use 9600 bauds for wired communication.
- UART implements error-detection in the form of parity bit.

VI. SOFTWARE

Inkscape is professional quality vector graphics software which runs on Windows, Mac OS X and GNU/Linux. It is used by design professionals and hobbyists worldwide, for creating a wide variety of graphics such as illustrations, icons, logos, diagrams, maps andweb graphics. Inkscape uses the W3C open standard SVG (Scalable Vector Graphics) as its native format, and is free and open-source software.The Inkscape project has a growing international user community, and many learning materials exist to help get you started with your creations. Helpand support is provided by the community,and there are lots of ways for you to get involved if you want to help improve the Inkscape project.



VII.WORKING

We use two software for controlling the project. both the software is based on java programing for engraving on any object the steps are as follows:

- We have to use LX easy G-code tool. This software converts image into G-code.
- First open software then click on image software after that image is selected from the storage. Then it is drawn in working area of software. Then decide the size of the image in inches. select Vector –G code and increase intensity. select Generate G-code option after generating G-code list this list edit first line as “G0 X0. Y0. F100” then save this list on desktop.
- Open second software that is G-code sender in this check out port is COM8. click on open option then select file mode and click on browse command. after that select saved G-code list then just select machine control click on $X command. then we manually using software control X and Y axis taken at edges of machine and then we select reset zero command after that click on send option to execute the program.

VIII.TESTING

1. During testing it was observed that the stepper motor isworking very properly. Electronics circuits we used were working properly. The hardware was also sustaining in sufficient strength and was strong. But we got some errors while testing the setup in the laser module and timing belt.
2. Before starting actual engraving, it is needed to set the zero (0) for the machine using software. That time when using software due to excess steps given to the stepper motor belt got over tensed and it got separated. After that was joined again.
3. Again, issue was created with laser, that laser was not starting with its full intensity. Due to which we were not able to engrave on worksheet. That was happening due to loose connections of laser with computer and also was possible due to the faults in program we created.

Later that was solved.

IX CONCLUSION

Mechatronics represents a unique combination of interdisciplinary and intelligent engineering science that features an interdisciplinary knowledge. Mechatronics is a fusion of mechanics, electrical, electronics, informatics and intelligent systems.Mechatronics is a study which focuses on producing engineers who can work inn high-technology environment and emphasize on real-world hands-on experience and engage in challenging problems and complex tasks with innovation and enthusiasm.

REFERENCES

- A LOW-COST BUILD-YOUR-OWN THREE AXIS CNC MILL PROTOTYPE By, Sundar Pandian and S. Raj Pandian, ISSN (Print): 2321-5747, Volume-2, Issue-1, 2014, LSMSA, Natchitoches, LA 71457, USA & Velammal College of Engineering& Technology, Madurai 625009.
- Fabrication of Low Cost 3-Axis Cnc Router, BY, Dr.B. Jayachandraiah, O. VamsiKrishna, P. Abdullah Khan, R. Ananda Reddy. International Journal of EngineeringScience Invention, ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726, www.ijesi.org Volume 3 Issue 6‖ June 2014 ‖ PP.01-10