

Automatic Letter Writing Machine

Dean of academic, Prof. Dr. Ir Asokraj Kumar.M, Ranganathan.C, Sathiyaraj.R, Siva. A , Srinivasan.R

Department of Mechanical Engineering,
Gnanamani College of Technology.
Email:ranganathanc99@gmail.com

Abstract – In this project “AUTOMATIC LETTER WRITING MACHINE” for accurate building drawing. The main components are Arduino controller, pen writer, Stepper motors, Servo motor, motor drivers and Transformer. This whole system is working based on source codes. Drawing perfect sketch by hand can now be done by machines too. Here we propose an automated image sketching machine that sketches drawings similar to a copy of art /letter but with a lot more accuracy. The proposed system makes use of an Arduino based circuitry that is interfaced with motors and belt- based setup that is used to provide the mechanism needed by a pen to draw the sketch. The Arduino based circuit is interfaced with 2 stepper motors and one servo motor in order to transmit the movement commands as per the image fed to it. It then controls the sketching process through a well-controlled mechanism in order to achieve this task. The pen only touches the paper where a line is to be placed is raised above the paper by the motor where not needed. This motion coupled with the x and y axis movement of the motors allows for a 2D sketching mechanism on the paper free theory the Grammy letter and entire art .

Keywords – Arduino controller, pen writer, Stepper motors, Servo motor, Motor drivers, Transformer.

II. INTRODUCTION

This project is about to design and to save the signature of any person in the database of the module which will be start printing as per the user thumb authentication system. This technology will help the disable person for giving signature as per their thumb impression. This technology based on CNC machine pen plotter system. Introduction to plotter: In today's world the basic requirement of any industry is to produce large quantity and quality products with low production and installation cost having high surface finish and great dimensional accuracy. So this can be achieved by a machines which are controlled by computer i.e. Computerized numerical control Machines. They are basically known as CNC machines. By using a CNC machine the products are produced at a faster rate with high accuracy and less human interference. The CNC machines usually are of various types. The most common used CNC machines use two-axis CNC machine and three-axis CNC machine. The CNC machine is a system. This system consists of three important parts viz. Mechanical design, Drive modules, and system software. The mechanical design consists the body of the system. The drive modules consist of the raspberry pi. And finally the System Software is used to generate the drawing on the sheet. Automatic letter writing machine is the automation of machines that are operated by precisely programmed commands. The main function of Automatic letter writing machine is used for plotting various drawings of products. The working principle of Automatic letter writing machine is very similar to CNC machine. In this system instead of plotting the drawing of product by hand, it is plotter by a computer controlled

pen. It produced a high quality work as compared with the human work. Automation and precision are the main advantages of CNC plotter table. In this project, we will show how to build your own Automatic letter writing machine.



Fig.1. Automatic Letter Writing Machine

II. OBJECTIVES

The main objective of this project is to provide plotting/drafting operation as an alternative for traditional manual operations done by manually operated mechanism. To ensure error free divestment.

The project is used as a principle which resents the plotting operation which can be replaced by any other cutting tools such as Drilling machine, Milling cutters, even Laser cutter, etc.

“AUTOMATIC LETTER WRITING MACHINE” is a cheaper CNC than plotter and can be easily made by waste wood and hardware parts.

The plotting can also be used for drafting purposes and research purposes worst of than used in copying purpose.

The objectives of this project is to design and implement a CNC plotter machine which will be able to draw a signature of any person by using authentication system on a solid surface.

The interface which is used to run the setup is also very easy to operate as we just have to input the commands in the forms of the G and M codes.

The CNC machines of small size are having a very easy operation and are very easy to understand the movement of arms in x and y direction for accurate drawing.

III. LITERATURE REVIEW

1. CNC stands for “Computer Numeric Control” and typically refers to a machine whose operation is controlled by a computer. The most common usage of CNC, and the one relevant to us, is the name given to devices that, under computer control are able to cut, etch, mill, engrave, build, turn and otherwise perform manufacturing operations on various materials. But in letter writing machine, no materials are removal, only draw lines arm copy axis
2. Motion is controlled along multiple axes, normally at least two (X and Y) and a tool spindle that moves in the Z (depth). The position of the tool is driven by direct-drive stepper motor or servo motors in order to provide highly accurate movements, or in older designs, motors through a series of step down gears. Open-loop control works as long as the forces are kept small enough and speeds are not too great. On commercial metalworking machines, closed loop controls are standard and required in order to provide the accuracy, speed, and repeat-ability demanded.
3. Typically, a CNC machine has the ability to move a cutting or 3D printing head in 2 to 6 axes, meaning that it can position that tool head at a precise point in or on the material to create the cut or operation desired at that point. By moving the head through multiple points, the cutting head can cut or sculpt the design represented by a data stream of positioning points being sent by the PC. By controlling a CNC machine through a PC it is possible for the user to design a product on-screen, convert it to CNC-readable code and then send that data to the CNC machine for it to produce a physical copy of the item designed.

IV. COMPONENTS REQUIRED

1. Arduino Uno R3
2. CNC Shield
3. Stepper Motor drive
4. Transformer
5. Bridge rectifier
6. Servo motor

V. ARDUINO UNO R3:

Arduino is the heart of the project; hence it should be selected by proper selection. In our project we have selected Arduino Uno R3 which only runs on G-codes. The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started

The board features an Atmel ATmega328 microcontroller operating at 5 V with 2Kb of RAM, 32 Kb of ash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source.

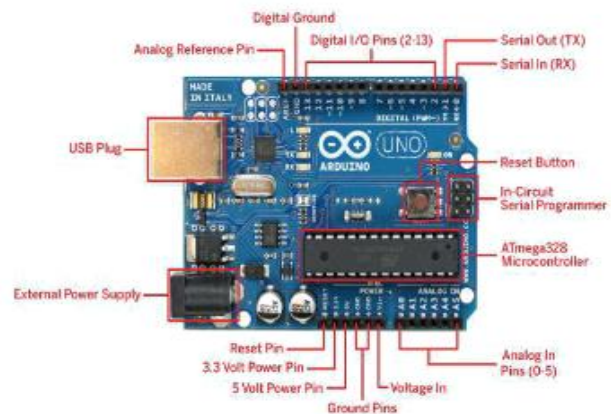


Fig.2. Arduino Uno R3

VI. CNC SHIELD

CNC shield consists of 4 axis control drives on it i.e. X-Y axis for only motion and Z-axis for the cutting tool depth/motions, whereas the last axis i.e. A-axis is for the optional for providing the rotational motion to the cutting tool such as rotational motion for drilling operation, etc.

Each axis has 3 jumpers that can be set to configure the micro stepping for the axis.

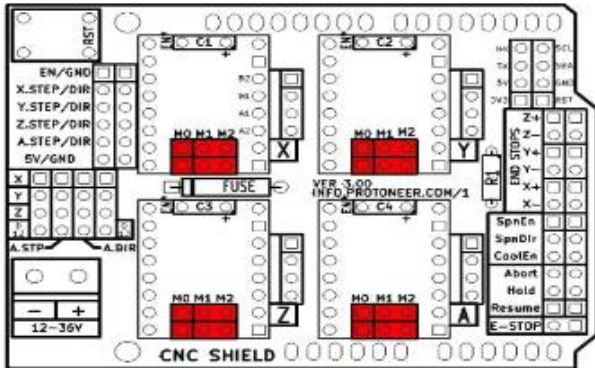


Fig.3. CNC shield.

1. Stepper motor

A stepper motor is an electro-mechanical device that converts electrical power into mechanical power. It is also a brushless, synchronous electric motor that can divide a complete rotation into a wide range of steps. The stepper motor uses magnet operation theory to turn the motor shaft into an accurate distance when an electrical pulse is provided. There are eight poles in the stator, and six poles in the rotor. To make one complete revolution, the rotor will require 24 pulses of electricity to move the 24 steps.



Fig.4. motor.

2. Transformer

The main principle of operation of a transformer is mutual inductance between two circuits which is linked by a common magnetic flux. A basic transformer consists of two coils that are electrically separate and inductive, but are magnetically linked through a path of reluctance. The working principle of the transformer.

As shown above the electrical transformer has primary and secondary winding's. The core laminations are joined in the form of strips in between the strips you can see that there are some narrow gaps right through the cross-section of the core. These staggered joints are said to be 'imbricated'. Both the coils have high mutual inductance. A mutual electro-motive force is induced in the

transformer from the alternating flux that is set up in the laminated core, due to the coil that is connected to a source of alternating voltage. Most of the alternating flux developed by this coil is linked with the other coil and thus produces the mutual induced electro-motive force. The so produced electro-motive force can be explained with the help of Faraday's laws of Electromagnetic Induction as $e = M \cdot di/dt$.

If the second coil circuit is closed, a current flows in it and thus electrical energy is transferred magnetically from the first to the second coil.

The alternating current supply is given to the first coil and hence it can be called as the primary winding. The energy is drawn out from the second coil and thus can be called as the secondary winding.

In short, a transformer carries the operations shown below:

- Transfer of electric power from one circuit to another.
- Transfer of electric power without any change in frequency.
- Transfer with the principle of electromagnetic induction.
- The two electrical circuits are linked by mutual induction.

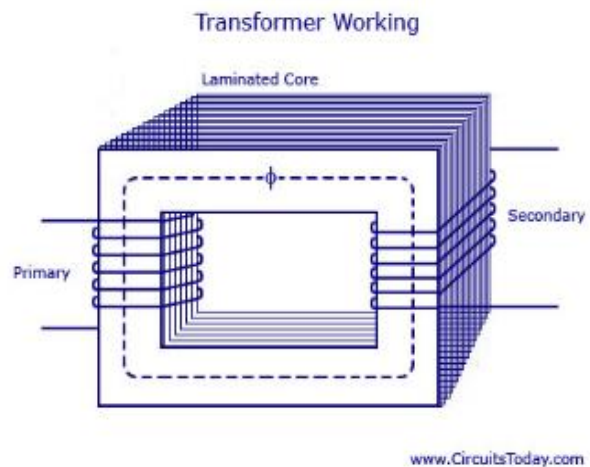


Fig.5. Transformer.

A Bridge rectifier is an Alternating Current (AC) to Direct Current (DC) converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices. They can be constructed with four or more diodes or any other controlled solid state switches.

Depending on the load current requirements, a proper bridge rectifier is selected. Components' ratings and specifications, breakdown voltage, temperature ranges, transient current rating, forward current rating, mounting requirements and other considerations are taken into account while selecting a rectifier power supply for an appropriate electronic circuit's application.

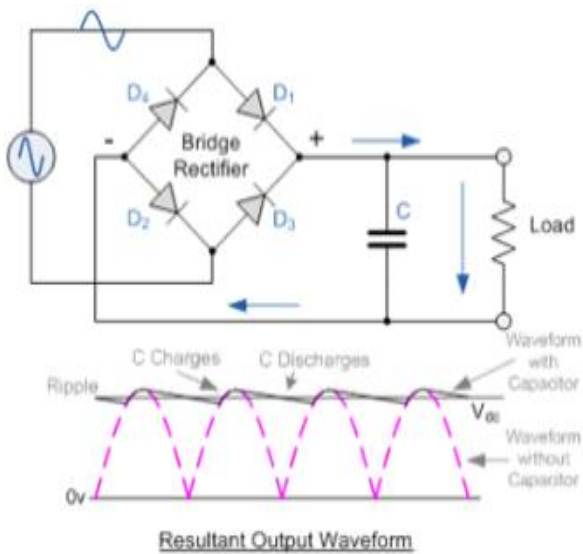


Fig.6. Bridge rectifier.



Fig.7. Bridge Rectifier.

3. Bridge Rectifier Operation

As we discussed above, a single-phase bridge rectifier consists of four diodes and this configuration is connected across the load. For understanding the bridge rectifier's working principle, we have to consider the below circuit for demonstration purpose.

During the Positive half cycle of the input AC waveform diodes D1 and D2 are forward biased and D3 and D4 are reverse biased. When the voltage, more than the threshold level of the diodes D1 and D2, starts conducting – the load current starts flowing through it, as shown as red lines path in the diagram below.

During the negative half cycle of the input AC waveform, the diodes D3 and D4 are forward biased, and D1 and D2 are reverse biased. Load current starts flowing through the D3 and D4 diodes when these diodes start conducting as shown in the figure.

We can observe that in both the cases, the load current direction is same, i.e., up to down as shown in the figure – so unidirectional, which means DC current. Thus, by the usage of a bridge rectifier, the input AC current is converted into a DC current. The output at the load with this bridge wave rectifier is pulsating in nature, but for producing a pure DC requires additional filter like capacitor. The same operation is applicable for different bridge rectifiers, but in case of controlled rectifiers thyristors triggering is necessary to drive the current to load.

This is all about the bridge rectifier theory its types, circuit and working principles. We hope that this wholesome matter about this topic will be helpful in building students' electronics or electrical projects as well as in observing various electronic devices or appliances. We appreciate you for your keen attention and focus on this article. And therefore, please do write to us for choosing required component ratings in this bridge rectifier for your application and for any other technical guidance.

4. Servo motor

Servo motor works on the PWM (Pulse Width Modulation) principle, which means its angle of rotation is controlled by the duration of pulse applied to its control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears.

Servo motor



Fig.8. Servo motor.

5. Stepper motor Driver

A stepper motor is used to achieve precise positioning via digital control. The motor operates by accurately synchronizing with the pulse signal output from the controller to the driver. Stepper motors, with their ability to produce high torque at a low speed while minimizing vibration, are ideal for applications requiring quick positioning over a short distance.

Stepper motors enable accurate positioning with ease. They are used in various types of equipment for accurate rotation angle and speed control using pulse signals. Stepper motors generate high torque with a compact body, and are ideal for quick acceleration and response. Stepper motors also hold their position at stop, due to

their mechanical design. Stepper motor solutions consist of a driver.



Fig.9. Stepper motor Driver.

A4988 stepper drive Used in Pololu stepper driver boards and the G3D driver. Identical and pin compatible to A4983, but also pull-up on M1 and motor short circuit protection. Full-, 1/2-, 1/4-, 1/8-, and 1/16-step modes

VII. WORKING PRINCIPLE

“It works on the G-codes generated by Inks-cape software and then simulated by GRBL software. The simulation runs the stepper motors results in to the useful mechanical output at the stepper motor and servo motor where carriage reciprocates as per signal given by software”.

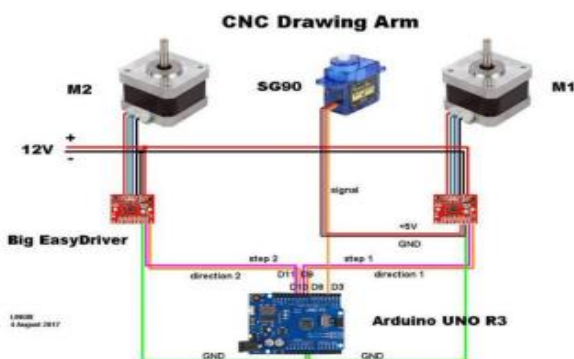


Fig.10.Block Diagram.

VIII. APPLICATIONS

1. 3D printing: By replacing the pen with 3d extrusion pen, we can perform 3D modeling which is the fastest growing technology in present not includes the third axis
2. Laser engraving: By replacing the pen with laser machine we can perform laser engraving operation for engraving different logo, trademarks, bench marks, etc.

3. Laser cutting: Instead of pen we can use laser cutters for high precision machining operations such as involute, cam, rocker arms and soon
4. Milling operations: We can even perform different milling operations such as slotting, grooving, etc. provided with overarm and arbor in CNC, But in Letter Writing Is Quite Similar And Form Only Drawing Letter Writing Work.

IX. CONCLUSION

We studied various types of CNC machines, its purpose their applications. We studied different research papers, patents and found out their limitations. We created G-code of PCB design using Inkscape software and simulated it using CAMotics software. Automatic mini CNC machine is designed and developed for PCB drawing using Arduino for low cost and for better accuracy. The latest award derelgam is used for Accuracy

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