

Autonomous Radium Cutting Machine

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Abstract- This study is carried out to produce two dimensional cutting machines that can be used for various purposes. For that mechanical parts initially required to be collected, need to be assembled and targeted mechanism can be created. After the integration of it into the mechanism that is created and the project framework can be revealed in a healthy way, the hardware structure can be completed by adding the necessary electronic components (motor drivers, stepper motor, servo motor, etc.). At the last stage, the inkscape software is used and gcode file can be created to transfer the two-dimensional drawings converted to vectors into paper.

The invention of the X-Y plotters is to recording or plotting two dimensional data on a rectangular coordinate system. This study emphasizes the fabrication of a XY plotter by using mechanism from scanner and microcontroller system (Arduino) to control the movement of XY axis. Modeling and analysis on X-Y plotter is carried out through the computer linked with the arduino software. It is executed through the algorithm and G-Code and Java programming.

Keywords- Arduino, X-Y plotter, CNC, G-code, Inkspace software

I. INTRODUCTION

The first commercial NC machines were built in the 1950's, and ran from punched tape. CNC, and later CNC, allowed for tremendous increases in productivity for machine tools because the machines could be run automatically without requiring constant attention from their operator. Computer numerical control (CNC) machines are automated milling machines that make industrial components without human assistance. This is possible because CNC machines are fed a series of instructions that are delivered to an internal computer controller. These instructions are in the form of codes that belong to the numerical control programming language. The code used to program CNC machines is generically called G-code. However, G-code instructions are only part of the programming language. Specifically, G-codes give CNC machines the coordinates.

Automation of 3 Motors to control the coordinates (X, Y, Z) of a pen or cutting tool with flexible head can be

used as Plotter or say cutter. The autonomous industries use various autonomous machines to do the difficult tasks. Unlike them in our daily life we don't and such automatic tool to cut shape as desire or required.

There are various techniques to provide the solution for selective use of industrial appliances. In autonomous industries, many devices are working without the human interference. The following papers are studied for getting the basic idea about what research is going on in the world regarding my project topic.

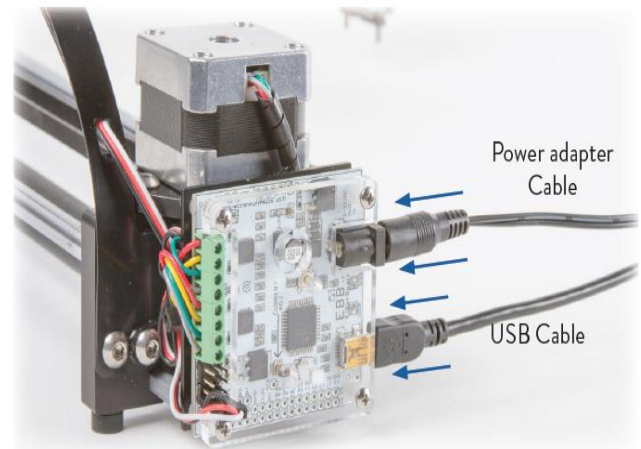


Fig1: Two Dimensional Cutting Machine

In recent years, developments in high strength magnetic materials have led to availability of compact, versatile, high power, high torque stepper motors and AC/DC Servomotors with built-in optical encoder feedback at low-cost.

Likewise, sensors such as optical encoders and Hall Effect sensors, tachometers, and load cells are also becoming smaller and cheaper. The increasing popularity of low-cost network technologies such as wireless Ethernet, Bluetooth, Zigbee, and wireless sensor networks, have also resulted in an ability to interconnect the limited number of available CNC machines to the multiple.

II. LITERATURE REVIEW

The equivalent work of autonomous radium cutting machine is explained in this section. There are various types of techniques which gives the solution for productive use. The following table describes about the analysis of methods used..

TABLE I: COMPARATIVE ANALYSIS OF TECHNIQUES

Author	Techniques	Advantages	Disadvantages
Sundar Pandian [1]	off-the-shelf component s, motors with drivers, Arduino Controllers	low-cost,easily customized, better access	Overdesigned, costly annual maintenance, time-consuming, expensive to repair
S. Y. Lin [2]	Assisted Machining Technique	good cutting performance and smaller cutting-tool wear	adjustment is conducted regularly
I.S. Nosirov [3]	Neural Network Controller	minimum dimensions at high torque; maximum speed,overload capacity	the higher accuracy requirement
Lingling [4]	Multi-objective Simulated Annealing algorithm	integrated approach of process planning and cutting optimization for energy saving,	energy needs a machining process which can be analyzed by dividing the entire machining process into stages
Mikhail Yu. Kulikov [5]	Anodic Mechanical Machining	prevent a flaw getting, reliability is good	low reliability, complex
Tekumatla Shivakumar	Python based 3-Axis	Reliable	software is challenging to understand

[6]	CNC Plotter		low cost
Tao Wang[7]	Threshold RTOS-build Embedded CNC System for cutting.	minimizes the task schedule, real time operating	management tasks are often relative to human-machine interface
Ankit Khanna [8]	Arduino based embedded system	overheads in controlling, low cost	abrupt changes in the Speed of the motors.

In the entire study, it has been observed that the old technologies could be taken over by the effective use of autonomous radium cutting system. The previous technologies also have its merits and demerits as mentioned in the detail above.

III. PROPOSED SYSTEM

The block diagram consist mainly three blocks software subsystem, mechanical subsystem, electronic subsystem. These entire blocks have interconnection between them to make it possible to cut desire shape.

The proposed system controls the mechanical assembly by giving commands through software. The software used is INKSCAPE software. in that file the image or shape that we want to cut will get converted to gcode file. This file will be save with an extension .gcode.

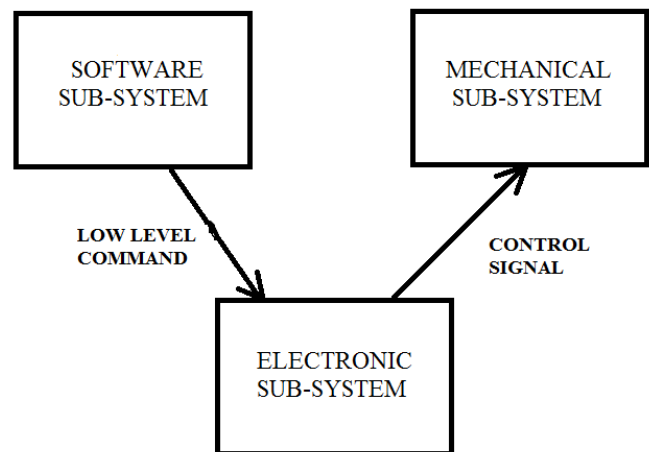


Fig 2: Proposed autonomous system

In designing the plotter, three main components need to be considered. These are the mechanical design, which consists of:

- i. The chassis, motors and timing belts, and the rails to position the print head on a two-dimensional grid.
- ii. The electronics to control the stepper motors and any limit switches used to ensure proper position.
- iii. The software to communicate with the hardware
- iv. In order to produce the expected output

First step to start building this device is get stepper motors. Next step is to choose our base for the x-y plotter. Finally i will need to find something to attach the one of the stepper-rails vertically to our construction the Y axis of my device.it can be Attach on surface, in this part i will need some screws and nuts. The X axis is attached to two plastic parts and it can be cut to the construction need to make sure to put the Y axis straight to x-y plotter base and the X axis vertically in this (90degrees). On that surface the servo motor (Z axis) will be attached to the cutter base cutter must be able to move up and down with the aid of servo motor. Now it will have to attach a hard surface on Y axis. On this, it will put the paper piece to print the texts or images that we programmed The printing area is 4x4cm (say). For steppers motors wiring, it will find a 'testing' code for x and y axis. If the steppers doesn't work properly, the correction can be obtained by working combination by changing the cables between them and the controller. To make g code _les that are compatible with this X-Y plotter, the inkscape is used. it is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specially designed to have as few implementation dependencies as possible. it can run on all platforms that support it without the essential for recompilation.

The proposed model will be enclosed in the wooden block or say casing in order to make it look more attractive. It will also prevent the model from shocks when it will be in working state.

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs like light on a sensor, a finger on a button, or a Twitter message - and turn it into an output like activating a motor, turning on an LED, publishing something online. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of

accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast Prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software is also open-source and it is growing through the contributions of users worldwide.

IV.RESULT AND DISCUSION

I will be using INKSCAPE software for generating the gcode of design that is to be get cut. Inkscape is an open-source vector graphics editor similar to Adobe Illustrator, Corel Draw, Freehand, or Xara X. What sets Inkscape apart is its use of Scalable Vector Graphics (SVG), an open XML-based W3C standard, as the native format. The design process may begin by doodles on a napkin, a sketched mind map, a photo of a memorable object, or a mockup in software which really wouldn't work to complete the project. Inkscape can take you from this stage to a final, professional-grade design format which is ready for publication on the web or in physical form. If you are new to the process of creating vector graphics it may feel different, but you will quickly be pleased by the flexibility, and power Inkscape offers. Vector design is often the preferred method of image creation for logos, illustrations and art which require high Scalability. The Inkscape application is used across a wide variety of industries (marketing/branding, engineering/CAD, web graphics, cartooning) and individual uses.

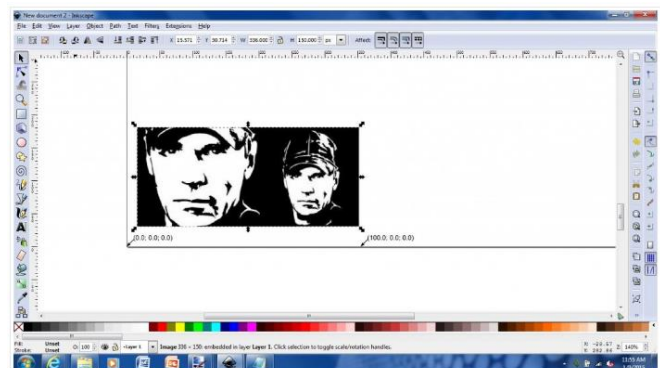


Fig 3: Inkscape Software

For cutting and engraving on the same file in inkscape, you need to make at two objects. One object will be

the engraving and one will be the cut outline. Select the engraving object and click object to path and run the inkscape plugin. Put the engraving cutting tool speed for the engraving. Then, click on the cut object (like a line border) and click object to path and run the plugin again. This time, put the speed to be a cutting speed (a lot slower) and use multiple passes if needed. Change the name of the _le and press apply (or have the add numeric suffix button enabled). You will now have an engraving G Code file and a cut g code.

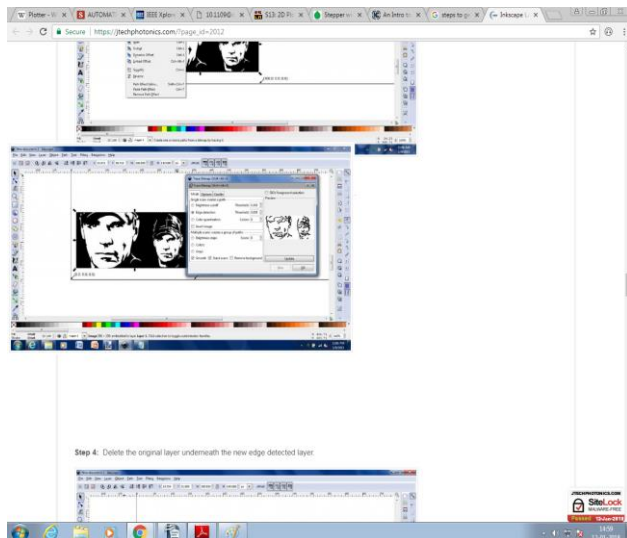


Fig 4: edge detection of image

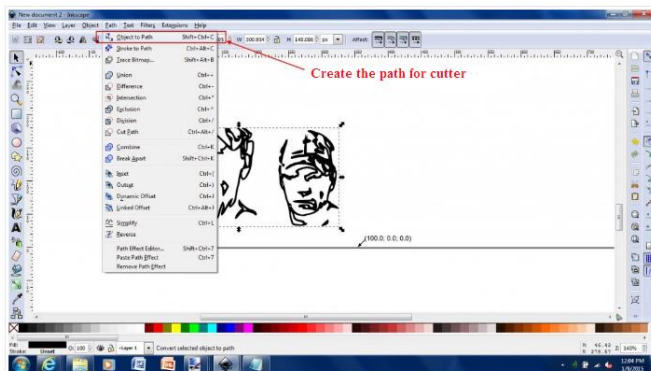


Fig 5: Path creation for cutter

IV. CONCLUSION

Through proposed work, it can be concluded that the smart device can be made with the help of software, hardware and few mechanical parts this proposed device can do the cutting of paper or radium of any desire shape. Also if the cutting tool is replace by writing device such as pen then the same device can be used as plotter or say automatic writing machine this device with few modifications can be used for signing documents from distant that is without being physically present as that spot. As the device is performing the cutting operation automatically and also it can be used for

drawing that is as a plotter hence it covers wide area of applications. Now this device is having wired connections. So wireless device can be a future model of this system. Also the addition of IOT with this system can make it more futuristic.

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