# DESIGN AND DEVELOPMENT OF AN AUTOMATED WRITING MACHINE

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**Abstract**

The recent shifts in industry trends have generated a technological revolution, resulting in the emergence of Industry 4.0 characterized by the growth of highly automated industries facilitated by human-machine collaboration. As the procedure becomes increasingly intricate and burdensome, the reliance on automation becomes more crucial in order to foster the expansion and effectiveness of a system. Automated machines possess greater precision, flexibility, and efficiency, thereby substantially decreasing the likelihood of errors. Over the past few years, multiple systems have been suggested to function as a writing machine with the ability to generate output in predetermined typefaces. The method described in this document focuses on identifying the text within the document and subsequently generating the output using the preferred font of the user. Furthermore, by employing this approach, the overall weight of the system is comparatively reduced compared to other writing machines currently on the market.

**Keywords:** Automation, CNC, Industry 4.0, Optical Character. Recognition, Text Extraction, Writing Machine.

## I. INTRODUCTION

As with the world embarking on a new era, manufacturing is experiencing a transformation referred to as Industry 4.0 or Smart Manufacturing. The rapid adoption of digital technologies such as industrial robotics, 3D printing, machine learning, optical character recognition, cloud computing, augmented reality, and sensors by various industries is contributing to the increasing feasibility of the Industry 4.0 revolution.



**Fig 1: Writing Machine**

Humans are increasingly relying on robots to perform tasks and lessen their own physical exertion. In our rapidly changing society, the availability of time and skilled workers is the primary limitation when it comes to accomplishing tasks efficiently and on a large scale. As a result, automation is greatly reducing the amount of human effort required in various routine tasks such as welding, painting, assembly, container filling, writing, and more. When it comes to writing, one can eliminate the time-consuming and skill-intensive task of typing on a keyboard by utilizing automation.

Automated voice-to-text converters are utilized specifically for writing using pre-installed fonts like Roman, Calibri, Arial, Impact, Georgia, among others. The objective of the document is to create and construct a system that can write on a sheet using a pen in the user's unique handwriting or any predetermined fonts if necessary.

This marks the introduction of CNC machines, renowned as computer numerical control machines, as a distinctive and adaptable form of flexible automation. Originally, its purpose was to control the movement and functionality of machinery tools. An automated machine capable of writing can be created by employing concepts such as CNC machines, and addressing the hardware arrangement of the suggested system.

While humans have the ability to understand the information conveyed by an image through visual analysis and reading the accompanying text, computers require a more structured approach in order to comprehend such content. Images are read by computers. The process of Optical Character Recognition involves identifying and acknowledging text within digital images, and subsequently transforming this text into a format that computers can easily comprehend. Recognition of car number plates from a camera and conversion of hand-written documents into digital copies are among the applications that have been utilized.

## II. EXISTING SYSTEM

The present technologies like printers and scanners are that they only write in predefined fonts present in the computer. It is handled through a blackboard presentation or PowerPoint presentation Blackboard presentation is the process held from the ancient days which is defined as boring by children. To improve PowerPoint presentation is used which is more interesting and easy to understand than blackboard teaching.

### A. Drawbacks:

The major drawback of this paper is the same process of teaching leads to a boring environment for neither teacher nor the student. This system leads to reduce the interest in a student's observing capacity.
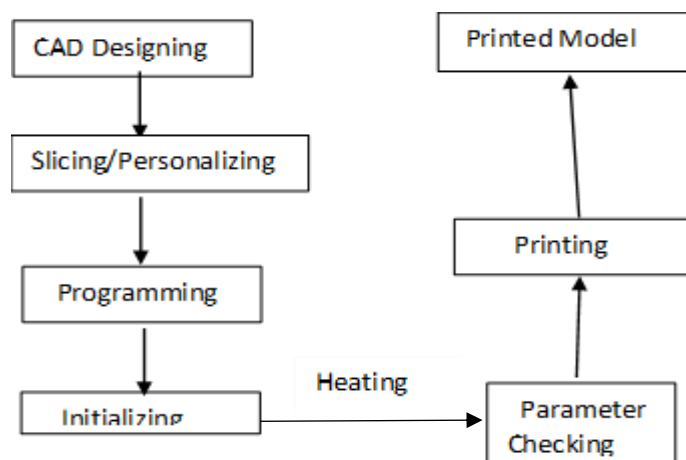
**Fig 2: Flowchart**

## B. Literature Survey

**Polygraph:**

In 1803, John Isaac Hawkins was the pioneer in creating the initial machines that replicated signatures. These machines, referred to as polygraphs, bear a resemblance to modern autopens both in their design and how they function. The Polygraph was utilized to produce a duplicate of a document with the help of pens and ink.

**Typewriter:**

In 1874, the inaugural commercial typewriter was unveiled. It was a device utilized to transcribe characters by means of a set of keys.

**Telautograph:**

The credit for this is given to Elisha Gray in 1888. The potentiometer creates electrical impulses that are sent from the starting point to the destination point. A pen attached equipped with a servomechanism is present at the receiver.

**Autopen:**

An autopen is a term used to describe a device, also known as a signing machine or robot pen, which is utilized for the purpose of automated signing. Invented in 1980, the device served to store signed signatures.

**Long Pen:**

In 2004, writer Margaret invented the long pen as a modified version of the autopen. This device enables users to write in ink remotely from any location by using a PC, internet connection, and a robotic hand.

## III. TOOLS REQUIRED

### A. Hardware

**Stepper Motor:** Stepper can be changed over the computerized beat into the development of pen as for pivot X, Y, Z heading. A stepper engine is a brushless engine that partitions a full turn into various equivalent advances, the stepper engine is known by its property to change over various driving forces into a characterized increase in the shaft position. Each heartbeat moves them through a proper point. We have utilized 3 stepper engines with a lead screw. The engine result will be as the pivot of the



**Fig 3: Stepper Motor lead screw**

**Servo Motor:**

**Stepper Motor:** Stepper can be changed over the computerized beat into the development of pen as for pivot X, Y, Z heading. A stepper engine is a brushless engine that partitions a full turn into various equivalent advances, the stepper engine is known by its property to change over various driving forces into a characterized increase in the shaft position. Each heartbeat moves them through a proper point. We have utilized 3 stepper engines with a lead screw. The engine result will be as the pivot of the



**Fig 4: Servo Motor**

**Arduino:**

Arduino will be characterized as it is gotten the order or information from the PC with the assistance of a USB link. It is mounted on n CNC safeguard, it will move information from Arduino to the CNC safeguard by utilizing a stepper driver. Arduino UNO is a microcontroller

board, it contains everything expected to help the microcontroller, basically interface it to a PC with a USB link and a power source. It controls the place of the stepper engine with h assistance of a program. It is an open-source stage given simple to-utilize equipment and programming. T has advanced and simple information/yield pins which might connect into different extensions at any point board and different circuits and microcontrollers with corresponding parts that aides in programming and joining into different circuits. The current provided 5 volts with a USB link.

## B. Software

### Inkscape 0.48.5:

The plotted diagram or text can be created using Inkscape. In this project, a G-code file is generated using this software, which converts a chosen image or text. G-code is a widely employed programming language for numerical control, encompassing coordinates X, Y, and Z.

### Co-ordinates. Creating G-Code File Using Inkscape:

In order to work within the space limitations of our CNC plotter for this project, we have chosen to set the document properties in Inkscape to 40cmx40cm (Width × Height). The size mentioned is four times bigger than the actual working area of the plotter, which is limited to drawing within the first quadrant. In order to make design changes easier, we initially placed the axes at the nearest end of the motors, considering it as the starting point for reference. The text within the designated area in the image demonstrates the operational space of the CNC plotter. Use the cursor to highlight the text you want to save in G code format, then select "object to path" from the drop-down menu. A transparent background must be present in the file in order to generate the G-code for an image. Drag the image into the desired area first to make it transparent. After that, select "trace bitmap" from the drop-down menu. The scanning option is set to 8 and "Edge detection" is selected in order to produce black and white images. Once we inserted the transparent image into the designated section, we employed the "object to path" function to generate the G-code file of the chosen image, following the previously mentioned instructions.

### G – Coder:

This is presented by "G". G codes are predefining Functions associated with the Movement of the Machine Axis. It has Two Digits, Ex- G00, G81, and G90. It is possible to include more than one G address in one block. Provided these Functions are not mutually exclusive. Ex- G02 and G03 are together in one block is not Permissible. The g function defines the path to be followed in a complete design. ExG00- positioning.

G01- Linear interpolation

G02- Clockwise Circular interpolation

## C. Working

First, the system must have the Arduino software installed. Once the devices are fixed, the programming code will be uploaded to the Arduino Uno board the system's sensors identify the user, retrieve user input from stored documents, and then return the result and allow the user to begin writing on paper. The speech- independent system is less effective than the sensor. Due to pattern matching's inability to handle accents, varied delivery speeds, intonation, speaker-independent speech recognition has been shown to be highly challenging. The automatic pen also serves the purpose of enabling the user to create a new document that doesn't already exist on the hard drive or plates. The new document is kept on the hard drive for subsequent use.

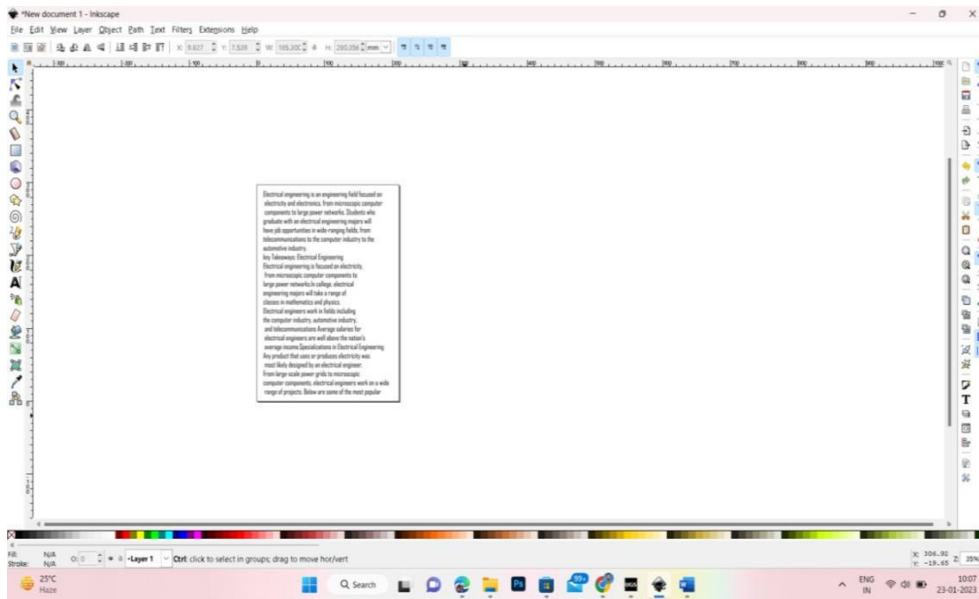Fig: The flowchart of the overall process in an automated writing machine
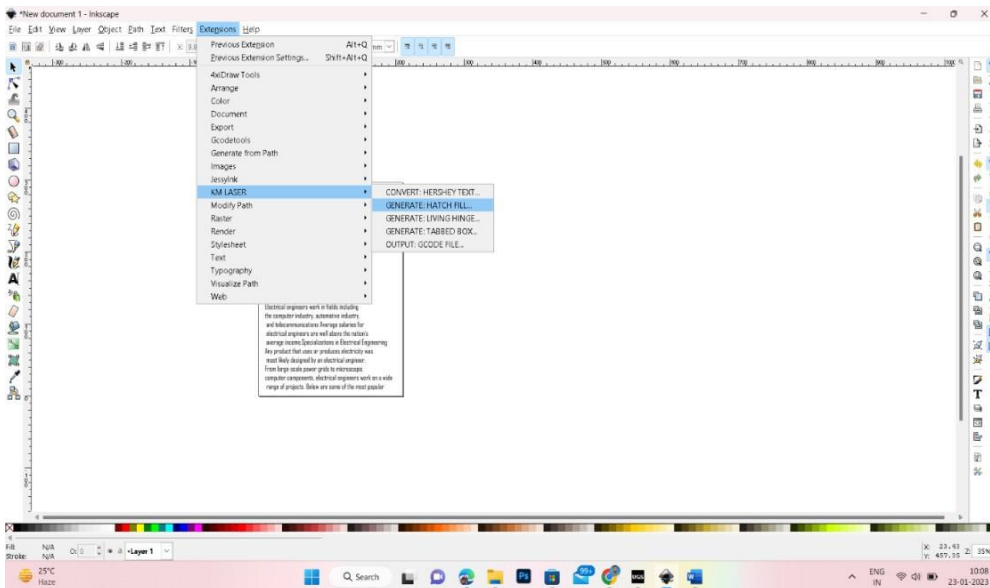
**Step 1:** Install Inkscape software 0.9.2
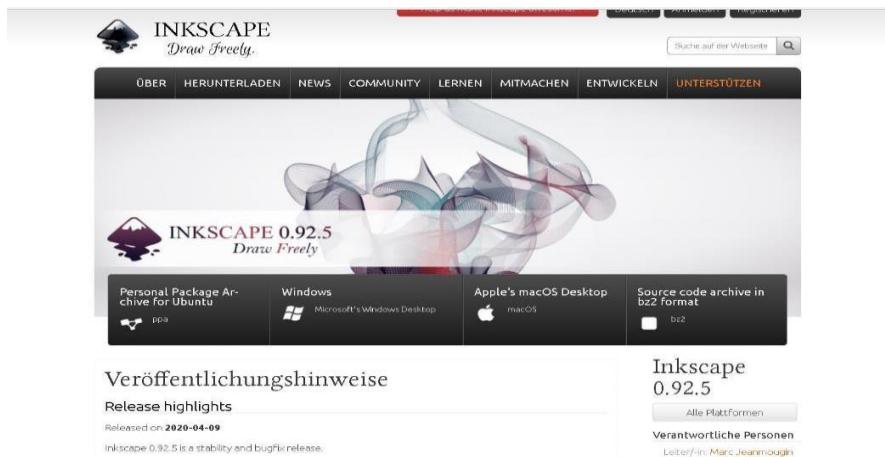


**Step 2:** Open the Inkscape application
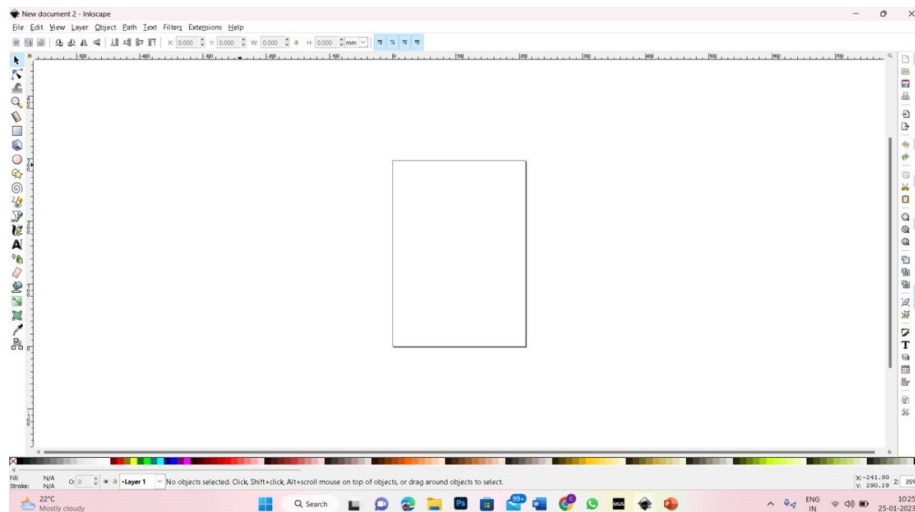


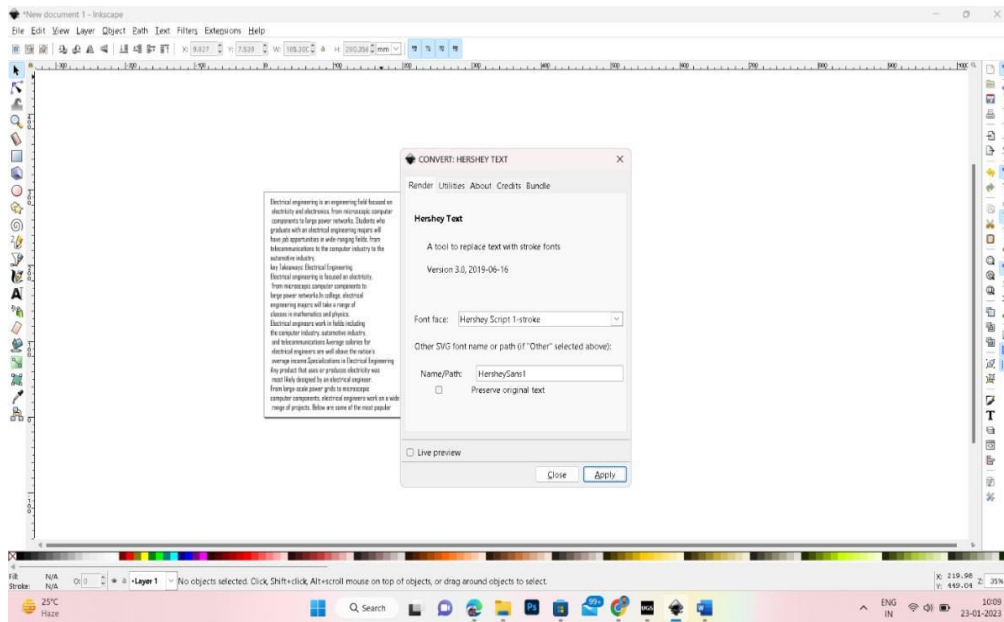**Step 3:** After that we can take text option and text

**Step 4:** We will go to the extension file and we can select ―KM laser‖ in that file.In KM laser we can select ―convert Hershey text‖ (for converting text into different fonts)
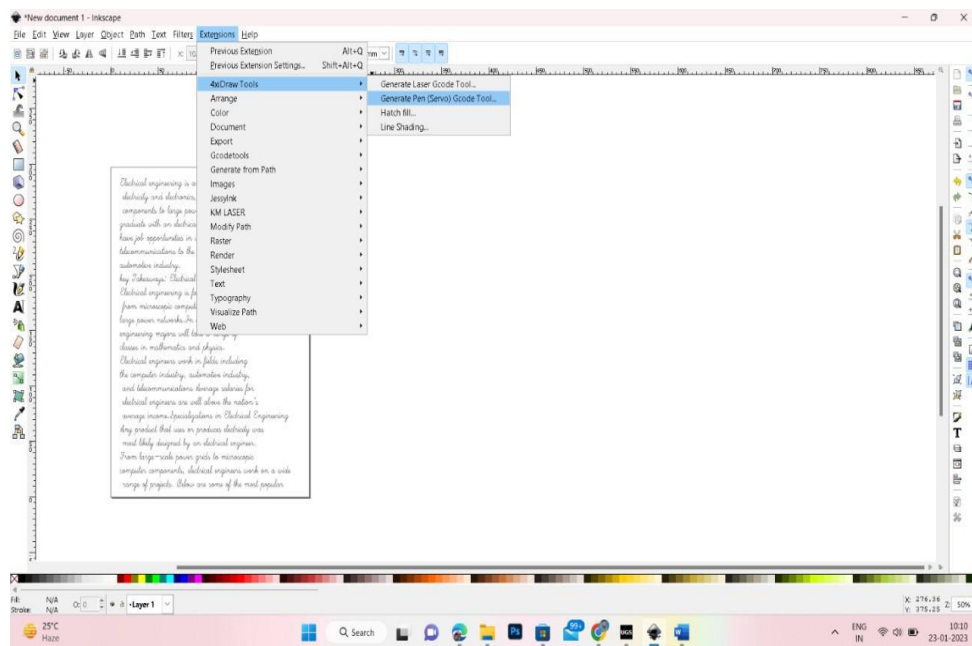


**Step 5:** After that font has been applied then it is converted in a selected font.
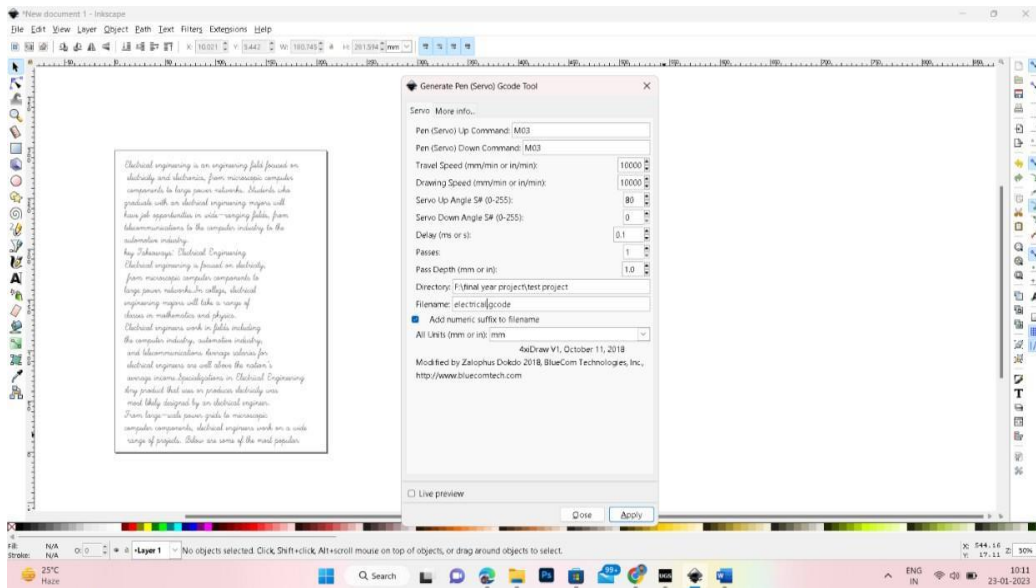
**Step 6:** We will go to the extension file to select ―4xdraw tools‖ again and select ―generate pen G-CODE tool‖.
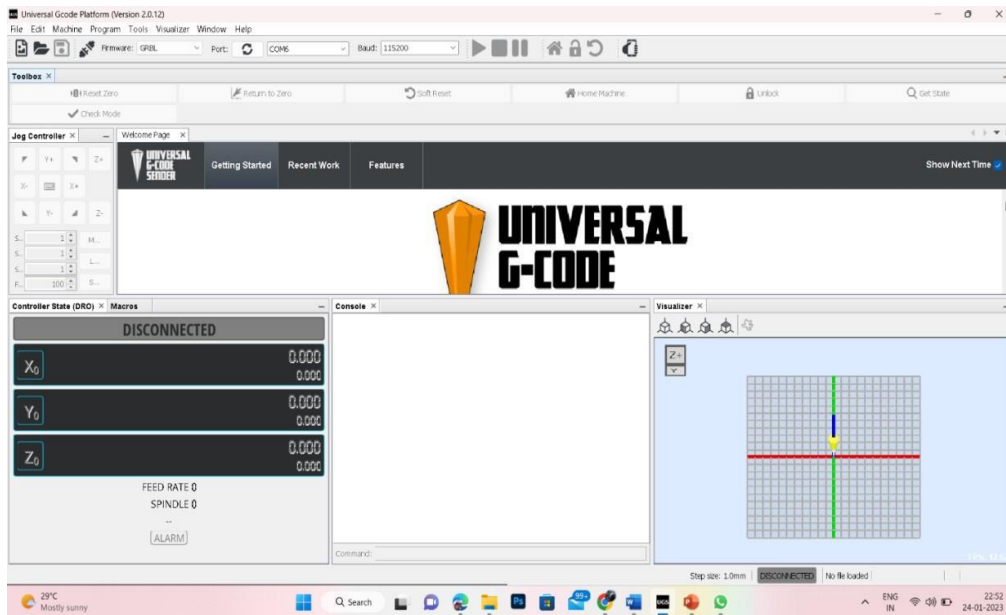


**Step 7:** We can select pen movement (up and down) travelling speed, servo angles and delay time. In dictionary we can select file location after we can give file name and click on the ―apply‖ option.
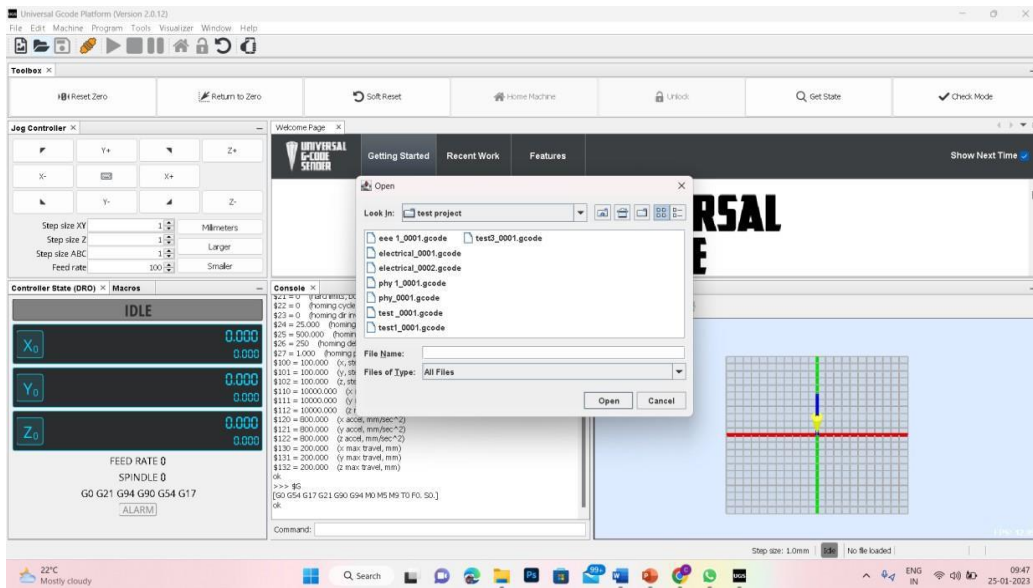
**Step 8:** Next open UGP (universal G-Code platform) version 2.0.12. we can connect Arduino connection whether it is Connect or not.



**Step 9:** Click on the connect or disconnect option. It is connected open file we can select file already which is saved in the inkscape after that we can select the file and open it. The automatically the source will display.

**Step 10:** In control state (DRO). We can set x-axis, y-axis and z-axis are zero. After we can run it. Before starting the pen movement in console we have to give commands for pen up and down.

<div align="center">Pen up=M03 S80; Pen down=M05 S10</div>
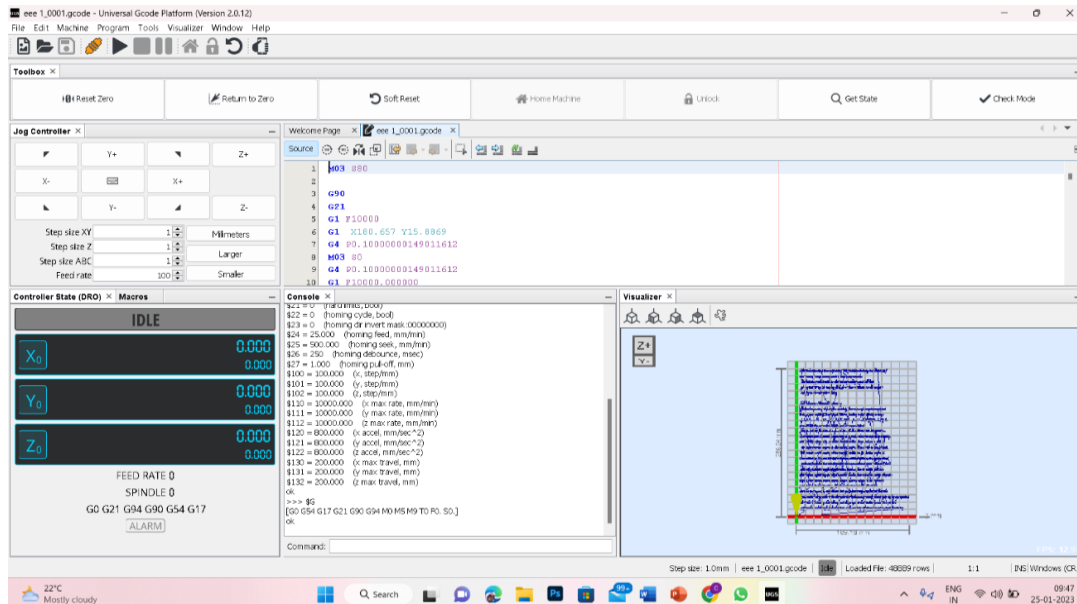
**Merits and demerits of CNC machines are given below**

- ➢ CNC machines have the capacity to operate non-stop for 24 hours a day, 7 days a week, all year round with the exception of occasional maintenance intervals when they require being turned off.

- ➢ CNC machines are equipped with a programmed design, enabling the replication of the same product numerous times, potentially in the hundreds or even thousands. Every produced item will be identical.

- ➢ Less skilled/trained people can operate CNC machines unlike manual lathes/milling machines etc. which need skilled engineers.

- ➢ CNC machines can be updated by improving the software used to drive the machines

- ➢ One option for receiving proper training on how to use CNC machines is by utilizing virtual software. This software functions similarly to a computer game, enabling users to simulate operating a CNC machine on their computer screen for practice.

- ➢ With modern design software, designers can simulate the production process of their ideas. Creating a prototype or model is unnecessary. Saves time, money.

- ➢ Once the CNC machines are programmed, they can typically operate autonomously, allowing a single individual to oversee multiple machines simultaneously. The cutting tools are the only items that may require occasional replacement.

The machine runs at a slow pace and generates excess heat which causes the heat sink to be heated quickly. A slight error may remain on the image file after it has been plotted due to one side of the Y-axis being fixed to the moving mechanism and the other end being free to move. The Z-axis is not very rigid so it causes slight vibration.

**Applications**

- ➢ Compact CNC/3D Printerby Brijesh Sondarva

- ➢ Mini CNC Foam Cutter by Jonahmarrs

- ➢ Mini Arduino CNC by me_ zain

- ➢ CD/DVD Bipolar Motor Driver W/o Microcontroller by Samiran

- ➢ CNC Programming G-Code Programming CNC Plasma Cutting byivanirons

- ➢ L293D driver board for CNC by Brijesh Sondarva

## Comparison of the proposed system with others

### Table 1: Comparison of the proposed system with others images

| PARAMETERS | EXISTING METHOD | PROPOSED METHOD |
|---|---|---|
| COST (RUPEES) | 8090 | 6003 |
| CONVERTER | OCR | CNC |
| FONT CONVERTER | POSSIBLE | POSSIBLE |
| WEIGHT (KGS) | 1 | 0.88 |
| SPEED (WPM) | 5-10 | 5-15 |
| ORIGIN | INDIA | INDIA |

**Result:**



**Fig 5: Input Image**



**Fig 6:  Output image**

**Fig 7: Pen movement how much speed it goes on x, y, and z-axis**

This paper proposes another sort of computerized composition machine which integrates optical person acknowledgment. The source code will remove the text from the info picture and afterward this extricated text is changed over into any of the predefined text styles put away in the PC or to the client's penmanship. The info picture which is a bit of a checked record in a predefined text style - "Arial" the removed text switched over completely to the client's text style.

> Amazon, the multinational e-commerce grant, has done the impassible and reached a staggering 18 Trillion dillars market cap in the past few years, and is expected to reach over 18 Trillion in revenues by the year 2025.

**Fig 8: Input in predefined text**

The textual style transformation is finished with the assistance of a web application. Here the client's sequential information is transferred and it is working to utilize this textual style.

The fundamental benefit of this framework lies in the expense of creation. Taking into account two monetarily accessible comparable frameworks with the end goal of examination.
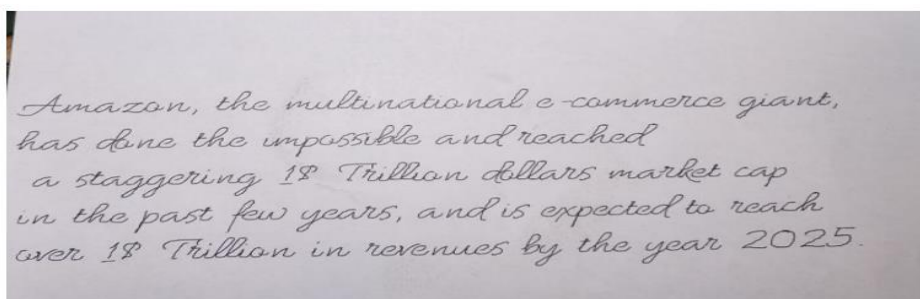


**Fig 9: Output Text**

Another notable aspect to keep in mind is the accuracy of the optical individual. The accuracy of text generated through CNC (Computer Numerical Control) in predetermined fonts is generally higher compared to human handwriting, with a success rate of around 95% or more depending on the specific font used.

The accuracy of CNC technology in recognizing human handwriting depends on the quality of the individual's handwriting, whether it is messy or neat. The machine's writing speed is nearly identical to that of an average person, which is 13 words per minute.

One of the limits of this venture is that the result would be able just to be written in block letters because of the laser etching programming utilized. This issue might potentially be tackled by utilizing different programming.

## IV. CONCLUSION

Humans are increasingly using robots to complete tasks in order to save time, resources, and produce goods that are effective. The fundamental issue with currently available technology, such as speech-to- text converters, printers, and scanners, is that they can only write in computer-predefined typefaces. The suggested system functions as an automatic writing device that may produce text in any specified font or according to the user's handwriting. Software and hardware integration produces a mechanical system that, with minimal human interference, creates an automated writing machine that is user-friendly and economical while also requiring less manual labour and time. In conclusion, the automatic writing machine will be able to help with the problems we face every day and so raise our quality of life.

### Future Scope

Many future modifications can use the proposed system as a starting point or foundation. A possible alteration could involve enhancing the writing speed to surpass the current level of achievement. Moreover, the integration of voice-to-text components into the existing proposed system would provide advantages for individuals with disabilities. An alternative adjustment could involve creating a system that operates in real-time, enabling the user to send text remotely for the machine to transcribe.

By integrating the utilization of the internet and cloud services into the procedure, this objective can be accomplished. This specific app can come in handy for alerting a family member when their phone's battery has died and consequently turned off. As of now, the accuracy of the proposed system's optical character recognition is lower for messy handwriting compared to predefined handwriting style.

Therefore, through improving the ability to recognize text more accurately, the system can be expanded to interpret doctors' prescriptions and subsequently convert them into the user's preferred language utilizing a language translation model.

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